

PHYSICS 1505 - INTRODUCTORY ASTRONOMY

Spring 2023

<https://umssystem.instructure.com/courses/150324>

Description

An introductory course in basic astronomy designed primarily for students other than those in science and engineering. Topics include history, the sky, the solar system, stars, stellar evolution, galaxies and the origin and evolution of the universe.

Instructor

Professor Marco Cavaglia

Office: Physics 204

Office hours: Tuesday and Thursday 12:00 p.m. – 1:00 p.m. Please confirm beforehand for availability.

Email: cavagliam@mst.edu

When emailing your instructor, please be polite and address him with his academic title. **Emails with no formal salutation or sign-off will not be answered.** Your instructor will strive to respond to your emails as soon as possible, but please consider that teaching this course is only one of his many duties. So please be patient. If you do not receive a reply within one working day, feel free to send a reminder.

Meeting time and location

Lectures: Monday, Wednesday, and Friday 3:00 p.m. – 3:50 p.m. in Physics 104.

Textbook (required)

J.O. Bennett, M.O. Donahue, N. Schneider, and M. Voit, *The Cosmic Perspective Fundamentals, 3rd edition*, Pearson (May 23rd 2019), url: <https://tinyurl.com/ynxj42yw>.

Objectives

Upon completing this course, the successful student will have a good understanding of the basics concepts of modern astrophysics.

Evaluation

Exams. There will be two midterm exams on Friday, February 24th, and Friday, April 14th, during class time. The final exam will be on Monday, May 8th, from 12:30 p.m. to 2:30 p.m. The first midterm exam will cover the course material from Wednesday, January 18th, through Monday, February 20th (inclusive). The second midterm exam will cover the course material from Monday, February 27th, through Monday, April 10th (inclusive). **The final exam will be in two sections. Section (a) is mandatory.** It will cover the material from Monday, April 17th, to Wednesday, May 3rd. **Section (b) is optional.** It will cover the material of the two mid-term exams. If you choose to take it and score better than in any of the mid-term exams, its score will replace the lowest of the two mid-term exam scores.

The exams will consist of a set of multiple-choice questions and two simple problems to be worked out. You will be allowed to use a calculator and may be provided with an equation sheet by the instructor. No use of notes or books will be allowed. If you miss an exam because of a civil duty (e.g., jury duty or military service), official university competitions, performances, or travel, religious observations, or certain scheduled medical procedures, they should inform the instructor ahead of time to arrange an accommodation. Missing an exam without prior notification of the instructor may lead to receiving a zero. However, illnesses and other problems, which sometimes occur unexpectedly, may lead to an accommodation in this policy.

Homework. There will be 11 assignments over the course of the semester, each worth 50 points. They consist of four multiple-choice questions (worth 5 points each) and two problems (worth 15 points each). The 10 best scores will count toward the final grade, i.e., the lowest score will be dropped. Assignments will be announced in class and must be uploaded in canvas before the date and time they are due. **Late submissions will not be allowed.** However, if there is a valid reason (e.g., due to documented illness), you may be excused from turning in an assignment on time. If you have extended unavoidable absences, the instructor may make some adjustments to the homework policy. Requests for regrades must be submitted before the end of the second class after graded assignments are returned.

Assignments must be easy to read. If you scan or take a picture of an assignment written on paper, please make sure it is well legible and has your name and assignment number clearly written in the top right corner of all pages. Show all your work; the answer alone is not worth anything. Solutions must be explained in enough text to be understandable. Numerical answers should have units and a reasonable number of significant digits. You should keep all returned assignments until the final grade of the course has been posted by the instructor. Transgression of the above rules may reduce your grade on the assignment.

Grading

Grade points will be based on assignments and exams as follows:

Homework	500
First mid-term exam	200
Second mid-term exam	200
Final exam (section a)	100
Final exam (section b)	200 ^(*)
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Total	1000

(*) If the score is higher than any of the mid-term exam scores, it replaces the lowest mid-term exam score. Otherwise, it counts as zero.

Grading scale (points):

- A:** 895 and above
- B:** 795 – 894
- C:** 695 – 794
- D:** 595 – 694
- F:** 594 and below

Course attendance policy

This course is **Classroom Based**. You are required to attend all classes. Please do not arrive late to class or leave early unless you have been previously excused by the instructor. Of course, if you are taken ill during class or in case of an emergency, feel free to leave. However, as soon as you feel better or the emergency is over, let the instructor know why you left. The instructor will not solicit details of the occurrence or any personal or private information.

Students with inadequate attendance may be dropped. Any student who has inadequate attendance, as evidenced by five confirmed absences or missing a total of five graded assignments of any kind (exams and/or homework), is subject to being dropped if a subsequent class or assignment is missed.

The university requires that all students have their course attendance verified at least once during the first two weeks of the semester. If your attendance is not verified, you will be

dropped from the course, and any financial aid will be adjusted accordingly.

Health and well-being

The physical and mental well-being of all students (and of the instructor) takes precedence over any other considerations in this course. The instructor will strive to keep the students safe and healthy. He hopes students will do the same for their well-being as well as the instructor's well-being. While no situation is risk-free, there are easy and effective actions you can take to protect yourself and others around you.

If you're feeling unwell, stay at home. Staying at home until you feel better or have been cleared to return to campus by health officers reduces the risk that you will pass on an illness to your friends, fellow students, your instructor, and others in your community. It will help ensure a smooth educational experience over the semester, as well as reduce the burden on our health services. Please contact Student Health Services at mstshs@mst.edu and/or 573-341-4284, if you become ill or are unable to attend class or take tests on campus.

COVID-19. To protect our campus community and each other from the risks of COVID-19 infection, Missouri S&T strongly encourages all students, faculty, and staff to be up-to-date on COVID-19 vaccinations. A combination of vaccination, staying home when you are sick, and seeking testing when you have symptoms of COVID-19 will be our most effective measures to mitigate against the spread of the virus. There is no requirement to provide proof of immunization, but voluntary reporting of vaccination information at can be done at <https://studenthealth.mst.edu/>. If you are isolating, you will receive an absence note from Student Health and not Student Support and Community Standards (Care Management). You will be responsible of forwarding the absence note to the instructor.

In the event of instructor or campus emergency the course will continue online on the zoom platform.

Academic dishonesty and disruptive behavior

Academic dishonesty and disruptive behavior will not be tolerated and will be dealt with in accordance with university policies. You should familiarize yourselves with the Student Conduct Rules of the University of Missouri in [Section 200](#) of the [Collected Rules and Regulations](#) to review the expected standards for student academic integrity, disciplinary procedures, sanctions, and appeal procedures.

In the event of disruptive behavior, the course instructors may request the campus Judicial Officer take effective disciplinary action after issuing a warning. See Student Academic Regulations at <http://registrar.mst.edu/academicregs>.

Disability policy

The Americans with Disabilities Act prohibits discrimination against and guarantees that people with disabilities have the same opportunities as people without a disability. The Missouri University of Science and Technology is committed to providing educational opportunities for all academically qualified students. Reasonable accommodations to ensure equitable access to its programs and services for individuals with disabilities will be made in compliance with the Americans with Disabilities Act.

At the beginning of the semester, students with disabilities who have had their status verified by the Office of Student Disability Services should get in touch with the instructor to go over their specific accommodation requirements.

To learn more about student disability services available to Missouri S&T students, please visit <https://dss.mst.edu/>.

Non-discrimination statement

The University of Missouri does not discriminate on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, or any other status protected by applicable state or federal law. The University affirms its commitment to providing equal opportunities by establishing the Equal Opportunity Policy statement in [Section 600.010](#) of the [Collected Rules and Regulations](#). The University's nondiscrimination policies apply to any phase of its employment process, any phase of its admission or financial aid programs, and other aspects of its educational programs or activities.

Additionally, this policy and the existing Title IX policies apply to allegations of sexual misconduct or allegations of other forms of sex discrimination, as defined in [Section 600.020C](#), occurring within the University's educational programs and activities and instances occurring in other settings, including off-campus, if there are effects of the conduct that interfere with or limit students' ability to participate in or benefit from the University's educational programs and activities.

Missouri S&T's Title IX Coordinator is Paul Hirtz. Contact him (hirtz@mst.edu; (573) 341-7734; 900 Innovation Drive - Suite 500) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit <http://titleix.mst.edu>.

Changes to syllabus

If a revision of the syllabus becomes necessary during the semester, it will be discussed in class.

Statement of agreement

Please carefully review and print for your records this syllabus. **By taking this class, you confirm that you have read and understood this document and are agreeable to the policies and provisions set forth therein.**

Appendix: Other resources

Writing Center. The Writing Center's mission is to assist all students in their efforts to become better writers, communicators, and critical thinkers. They offer clients structured one-on-one and small-group conversations with peer consultants. Writing Center consultants are fellow students whose strong writing skills and special training allow them to offer meaningful feedback and guidance for any genre of writing. Students, faculty, and staff across all disciplines can make appointments in-person, online, and asynchronously. More information can be found at their website and through email: writing@mst.edu.

Student Success Center. The Student Success Center (SSC) supports student development through individualized tutoring, peer-to-peer life skill coaching, and campus programming – all while providing free coffee and hot beverages! The SSC was developed to provide additional assistance for students academically and help bolster non-academic life skills, such as goal setting and time-management. All student Miners are encouraged to utilize the SSC's free services to get timely support and to enhance their S&T Miner Experience. Visit the SSC at 198 Toomey Hall, contact us at success@mst.edu, or join us on social media@sandtssc. To see the course offerings and times for SSC Tutoring, visit studentsuccess.mst.edu/tutoring/.

UCARE. UCARE is the central point of contact to connect a student who may be experiencing a personal, academic, financial, wellbeing, and/or other concern to support and resources. Sharing your concern with UCARE helps connect a student with solutionfocused assistance to support their holistic well-being, success, and academic progress. A referral can be submitted at <https://go.mst.edu/ucare-refer> or by emailing ucare@mst.edu. For urgent matters, check out the after-hour and urgent resources.

Assignment schedule

	Lectures	Opens (Friday)	Due (Wednesday)
Assignment 1	January 18, January 20	January 20	January 25
Assignment 2	January 23, January 25 January 27	January 27	February 1
Assignment 3	January 30, February 1 February 3	February 3	February 8
Assignment 4	February 6, February 8 February 10	February 10	February 15
Assignment 5	February 13, February 15 February 17	February 17	February 22
Assignment 6	February 27, March 1 March 3	March 3	March 8
Assignment 7	March 6, March 8 March 10	March 10	March 15
Assignment 8	March 13, March 15 March 20, March 22 March 24	March 24	April 5
Assignment 9	April 3, April 5 April 7	April 7	April 12
Assignment 10	April 17, April 19 April 21	April 21	April 26
Assignment 11	April 24, April 26 April 28	April 28	May 3

Part I: The solar system (Roughly Chapters 1-6, January 18 through February 22. Section numbers are approximate.)

	Monday	Wednesday	Friday
Week 1		January 18 Introduction. The scale of the universe. [1.1]	January 20 The age and the history of the universe. [1.2,4.3]
Week 2	January 23 Earth's seasons. [2.1]	January 25 The Moon. Eclipses. [2.2]	January 27 Planetary motion. Solar system models. [1.3,3.1]
Week 3	January 30 Star distances. Parallax. [2.3,12.1]	February 1 What is science? [3.2,3.3]	February 3 Light and telescopes. [3.1,5.1]
Week 4	February 6 The solar system. [4.1]	February 8 The terrestrial planets. [5.1]	February 10 Evolution and comparison of terrestrial planets. [5.2,5.3]
Week 5	February 13 The gas planets [6.1]	February 15 The small bodies of the solar system [6.2]	February 17 Search for life in the solar system [15.1]
Week 6	February 20 The formation of the solar system. [4.2]	February 22 First midterm review.	February 24 First midterm exam.

Part II: Stars (Roughly chapters 7-11, February 27 through April 12. Section numbers are approximate.)

	Monday	Wednesday	Friday
Week 7	February 27 Planets around other stars. [7.1]	March 1 Exoplanet pot-pourri. [7.2,15.2]	March 3 Radiation and spectroscopy. [8.1,8.3]
Week 8	March 6 The Sun. [8.1]	March 8 Stars. The HR diagram. [8.2,8.3]	March 10 Stellar structure. [9.1]
Week 9	March 13 Variable and double stars. Novae. [8.2,10.1,12.1]	March 15 White dwarfs and neutron stars. [10.1]	March 17 Spring recess.
Week 10	March 20 Black holes. [10.2]	March 22 Stellar explosions! Gamma-ray bursts and supernovae. [9.2,10.1-10.3]	March 24 Gravitational waves. [10.3]
Week 11	March 27 Spring Break.	March 29 Spring Break.	April 1 Spring Break.
Week 12	April 3 The life cycle of the stars. [9.2,9.3]	April 5 The milky way. Star clusters. Interstellar gas. [11.1]	April 7 The galaxy zoo. [11.2]
Week 13	April 10 Galaxy evolution, clusters, and supermassive black holes. [11.3]	April 12 Second midterm review.	April 14 Second midterm exam.

Part III: The universe (Roughly chapters 12-14, April 17 through May 5. Section numbers are approximate.)

	Monday	Wednesday	Friday
Week 14	April 17 Guest lecture: cosmology in the making.	April 19 The cosmic distance ladder. [12.1]	April 21 The expansion of the universe. [12.2]
Week 15	April 24 The big bang theory. [13.1]	April 26 Evidence for the big bang. [13.2]	April 28 Inflation. [13.2]
Week 16	May 1 Dark matter. [14.1]	May 3 Dark energy and the fate of the universe. [14.2,14.3]	May 5 Final review.