

PHYSICS 1505 - INTRODUCTORY ASTRONOMY

Spring 2024

<https://umssystem.instructure.com/courses/209162>

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: Wednesday 12:00 p.m. – 1:00 p.m. or by appointment. Please confirm beforehand for availability.

Email: cavagliam@mst.edu

Please address your instructor with his academic title when emailing him. **Emails that do not include a proper salutation or sign-off will not be responded to.** Your instructor will answer to your emails as quickly as possible, but please keep in mind that teaching this course is only one of his many responsibilities. Please be patient with him. If you have not received a response within one working day, don't hesitate 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>.

Course goals and student learning outcomes

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 23rd, and Friday, April 12th, during class time. The final exam will be on Monday, May 9th, from 3:00 p.m. to 5:00 p.m. The first midterm exam will cover the course material from Wednesday, January 17th, through Monday, February 19th (inclusive). The second midterm exam will cover the course material from Monday, February 26th, through Monday, April 8th (inclusive). **The final exam will be in two sections. Section (a) is mandatory.** It will cover the material from Monday, April 15th, to Wednesday, May 1st. **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.

Note regarding the usage of artificial intelligence (AI) and other cheating techniques. Your instructor knows how tempting it is to cheat on assignments by using AI, the natural intelligence of your classmates, or other in-person or online techniques. *“The fear of loss is a path to the dark side.”* However, keep in mind that: (1) AI is not as intelligent as you believe it is; (2) Based on the content of your assignment, your instructor can readily establish whether you cheated. If you think you outwit him because he does not say anything to you, it is because he knows you will pay the price for cheating later, when you will be unprepared for the exams; (3) **Your instructor strongly encourages you to work out assignments by yourself**, using only your mental capabilities; (4) If you do not, you’ll most likely score poorly on in-class tests and the final exam, where your only tool will be your brain trained on what you learned. There is an elevated risk that you will fail or receive a bad grade. *“Once you start down the dark path, forever will it dominate your destiny.”* **So think about it.**

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 ^(*)
<hr/>	
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

In this course, the physical and mental well-being of all students (as well as the instructor) takes precedence over all other considerations. The instructor will strive to keep the students safe and healthy. Your instructor 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 and other viruses. To protect our campus community and each other from the risks of viral infections, Missouri S&T strongly encourages all students, faculty, and staff to be up-to-date on vaccinations. A combination of vaccination, staying home when you are sick, and seeking testing when you have symptoms will be our most effective measures to mitigate against the spread of viruses. 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.

Copyright, FERPA, and use of electronic devices during class

It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions, whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided [online](#).

Note on the use of internet-enabled devices in the classroom. Your instructor's main goal in this class is to provide the best possible teaching experience. This includes mutual respect as well as cooperation among all parties (instructor and students). Students that browse the internet, chat with friends, or watch TikTok videos during class are a few instances of disrespectful student conduct. **Students that use electronic devices in the classroom will be requested to stop using them, unless there is a documented emergency. Students will be asked to leave if they do not comply. In the event of refusal, the behavior will be considered disruptive, and your instructor reserves the right to request that an appropriate disciplinary action be taken by the Campus Judicial Officer.** Please keep this in mind if you still choose to use electronic devices during class.

Accessibility and accommodations

It is the university's goal that learning experiences be as accessible as possible. Student Accessibility and Testing provides services and accommodations that facilitate full participation in Missouri S&T's learning experience for students with disabilities. If you anticipate or experience physical, academic, and/or digital barriers due to a disability, please contact Student Accessibility and Testing at (573) 341-6655, email dss@mst.edu, or visit <https://saat.mst.edu/> for information.

Academic dishonesty and disruptive behavior

All students are expected to follow the [Honor Code](#). **Academic dishonesty and disruptive behavior will not be tolerated** and will be dealt with in accordance with university policies.

[Student Academic Regulations](#) describes the student standard of conduct relative to the University of Missouri System and offers descriptions of academic dishonesty including cheating, plagiarism, sabotage, and unauthorized use of artificially generated content, any of which will be reported to the Vice Provost for Undergraduate Education. You should familiarize yourselves with the Student Conduct Rules of the University of Missouri in [Section 200.010](#) of the [Collected Rules and Regulations](#) to review the expected standards for student academic integrity, disciplinary procedures, sanctions, and appeal procedures. Other resources

for students regarding academic integrity can be found at this [link](#).

In the event of disruptive behavior, the course instructors will request the campus Judicial Officer to 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. Missouri S&T and your instructor are 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, equity and Title IX

Missouri S&T and your instructor are committed to the safety and well-being of our campus community, and to creating an environment free from discrimination and harassment.

Discrimination and harassment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law are prohibited. As used in this syllabus, the word “sex” is also inclusive of the term “gender.” During his responsibilities for this course, your instructor will uphold this policy.

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Sexual harassment violations of this law include quid pro quo, hostile environment, sexual assault, dating/domestic violence, and stalking. The U.S. Department of Education has stated the prohibition on discrimination on the basis of sex includes sexual orientation and gender identity.

Students who are experiencing pregnancy or pregnancy-related conditions, including the birthing parent and non-birthing parent, have rights protected under Title IX. Students should contact the Office of Equity and Title IX to learn more about their rights and

pregnancy-related assistance/accommodations provided by the University to ensure equitable access to University educational programs and activities.

In accordance with the University of Missouri's Collected Rules and Regulations, all faculty and staff are required to report any information concerning discrimination disclosed through communication including, but not limited to, direct conversation, email, social media, classroom papers and homework exercises to the Equity Officer/Title IX Coordinator.

For more information regarding support for those that have been impacted or to report an incident of discrimination or harassment as defined by [Chapter 600](#) of the University's Collected Rules and Regulations, visit the Office of Equity and Title IX or visit their website at equity.mst.edu.

Office of Equity and Title IX

Equity Officer and Title IX Coordinator: Dr. Paul Hirtz

Phone: (573) 341-7734

Location: 900 Innovation Drive, Suite 500

E-mail: equity@mst.edu

Changes to this 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

S&T provides resources to support your mental, physical, and social well-being. Any of us can experience challenges that make learning difficult. If you are struggling, take advantage of the following resources offered by the university:

Student Well-Being. Student Well-Being provides counseling services, health promotion initiatives, and prevention programs to empower the S&T community to thrive and enhance personal, academic, and professional success. Department office hours are Monday–Friday, 8 a.m. – 5:00 p.m. On the website, you can find information related to confidential individual and group counseling, wellness consultations and trainings, resources for many health and wellness topics, and help for mental health crisis situations.

For the National Suicide Prevention Lifeline, call or text 988, or visit missouri988.org.

Health and Well-Being Canvas Course. The [Health and Well-Being Canvas Course](#) features trainings, presentations, and other health and well-being resources for students. The course is free for all students, is non-credit, and students can enroll at any point in the semester.

Student Support and Community Standards. [Student Support and Community Standards](#) is your central resource for support. During your time at S&T, you or a friend may need help navigating their student experience, facing a barrier, or experiencing a challenge. You are not alone! Student Support has a dedicated team and numerous resources such as [UCARE](#) and the [student emergency fund](#) to help you navigate the S&T experience and support your success. This includes support to address barriers related to academic, personal, emotional, medical, financial, or any other needs. All students can learn and grow from challenges or setbacks, they are stepping stones to success and we are here to help.

Learning Assistance through LEAD. The [Learning Enhancement Across Disciplines \(LEAD\)](#) program runs Learning Centers and Tutoring which provide an efficient means to improve your understanding and increase your mastery of the material you are studying. Discipline-based faculty and undergrad peer instructors operate openenvironment learning centers in nearly every foundational course as well as many upper-level courses. See the schedule for LEAD learning assistance at <https://lead.mst.edu/schedule/>.

Writing and Communication Center. The [Writing and Communication Center](#)'s mission is to assist all students in their efforts to become better writers, communicators, and critical thinkers. The Center's peer consultants and coaches provide free individualized one-on-one and small group conversations to offer meaningful feedback and guidance to students across all disciplines. More information can be found on our website, through email: writing@mst.edu or stop by Curtis Laws Wilson Library 314–315.

Student Success Center. The [Student Success Center](#) (SSC) supports student development through peer Academic Mentoring focusing primarily on STEM courses, peer-to-peer soft skill coaching which can also act as an accountability buddy, and campus programming – all while providing free coffee and hot beverages! All undergraduate students are encouraged to utilize the SSC's free services to get timely support and to enhance their S&T Miner Experience. You can contact the SSC at success@mst.edu or 573-341-7590. To see the course offerings and times for SSC Academic Mentoring, visit <https://studentsuccess.mst.edu/academicmentoring/>.

Knack Tutoring (<https://mst.joinknack.com/>). Enrolled S&T undergraduate students can receive complimentary FREE tutoring assistance from peers who have successfully completed the course, available round the clock. You have the option to connect via the Knack platform online or in person on campus. If you've excelled in a course, consider becoming a Knack Tutor to support your fellow Miners!

Student Veterans Resource Center. The [Student Veterans Resource Center](#) (SVRC) is the nexus of resources and support for student veterans at S&T. The SVRC provides student veterans with a “safe space” and a familiar atmosphere. The center’s Veteran Consuls provide one-on-one consultations to guide students to various resources on campus, while its advisor provides students with VA health and benefits resources. Visit the SVRC at Harris Hall, Suite G10, or contact the center at svrc@mst.edu.

Assignment schedule

	Lectures	Opens (Friday)	Due (Wednesday)
Assignment 1	January 17, January 19	January 19	January 24
Assignment 2	January 22, January 24 January 26	January 26	January 31
Assignment 3	January 29, January 31 February 2	February 2	February 7
Assignment 4	February 5, February 7 February 9	February 9	February 14
Assignment 5	February 12, February 14 February 16	February 16	February 21
Assignment 6	February 26, February 28 March 1	March 1	March 6
Assignment 7	March 4, March 6 March 8	March 8	March 13
Assignment 8	March 11, March 13 March 18, March 20 March 22	March 22	April 3
Assignment 9	April 1, April 3 April 5	April 5	April 10
Assignment 10	April 15, April 17 April 19	April 19	April 24
Assignment 11	April 22, April 24 April 26	April 26	May 1

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

	Monday	Wednesday	Friday
Week 1		January 17 Introduction. The scale of the universe. [1.1]	January 19 The age and the history of the universe. [1.2,4.3]
Week 2	January 22 Earth's seasons. [2.1]	January 24 The Moon. Eclipses. [2.2]	January 26 Planetary motion. Solar system models. [1.3,3.1]
Week 3	January 29 Star distances. Parallax. [2.3,12.1]	January 31 What is science? [3.2,3.3]	February 1 Light and telescopes. [3.1,5.1]
Week 4	February 5 The solar system. [4.1]	February 7 The terrestrial planets. [5.1]	February 9 Evolution and comparison of terrestrial planets. [5.2,5.3]
Week 5	February 12 The gas planets [6.1]	February 14 The small bodies of the solar system [6.2]	February 16 Search for life in the solar system [15.1]
Week 6	February 19 The formation of the solar system. [4.2]	February 21 First midterm review.	February 23 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 26 Planets around other stars. [7.1]	February 28 Exoplanet pot-pourri. [7.2,15.2]	March 1 Radiation and spectroscopy. [8.1,8.3]
Week 8	March 4 The Sun. [8.1]	March 6 Stars. The HR diagram. [8.2,8.3]	March 8 Stellar structure. [9.1]
Week 9	March 11 Variable and double stars. Novae. [8.2,10.1,12.1]	March 13 White dwarfs and neutron stars. [10.1]	March 15 Spring recess.
Week 10	March 18 Black holes. [10.2]	March 20 Stellar explosions! Gamma-ray bursts and supernovae. [9.2,10.1-10.3]	March 22 Gravitational waves. [10.3]
Week 11	March 25 Spring Break.	March 27 Spring Break.	March 29 Spring Break.
Week 12	April 1 The life cycle of the stars. [9.2,9.3]	April 3 The milky way. Star clusters. Interstellar gas. [11.1]	April 5 The galaxy zoo. [11.2]
Week 13	April 8 Galaxy evolution, clusters, and supermassive black holes. [11.3]	April 10 Second midterm review.	April 12 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 15 Guest lecture: cosmology in the making.	April 17 The cosmic distance ladder. [12.1]	April 19 The expansion of the universe. [12.2]
Week 15	April 22 The big bang theory. [13.1]	April 24 Evidence for the big bang. [13.2]	April 26 Inflation. [13.2]
Week 16	April 29 Dark matter. [14.1]	May 1 Dark energy and the fate of the universe. [14.2,14.3]	May 3 Final review.