

COURSE INFORMATION

Description: This course is designed not merely to introduce you to concepts and big ideas in astronomy and cosmology, but also to show you how many things are still unknown out there, how many mysteries are waiting to be solved. We begin the course with the most mysterious and unknown part: the moment of origin of the Universe. We will explore how energy turned into the first atoms, followed by stars and galaxies. Then we will investigate the formation of galaxies, followed by the processes behind the formation of the stars and planets, and we emphasize the laws of physics steering this process. We will scrutinize the structures of the stars and planets so we can better understand the way they were born and how they will die. By the end of the course, you will be able to look at the sky and see not only pretty patterns made by the stars, but you will know what is happening inside of those stars and you will know what lies in those seemingly empty spaces in between the stars.

In addition, during this course you will learn how to be a scientist, how to think scientifically: you will learn how to notice facts around you and collect observational data, how to put these observations together to build your hypothesis or to test the hypotheses of others, how to test it, analyze it, and to come to a conclusion based on the results of your observations.

Let the journey begin!

Course Meeting Times/Place: online, including all assignments. You do not even need to be in the country!

Course Dates: June 4 – July 27, 2018

REQUIRED MATERIALS

Required textbook:

Astronomy! A conceptual introduction from the Big Bang to that asteroid heading right for us, by Wouter Montfrooij and Lanika Ruzhitskaya. Mizzou Publishing 2014. ISBN 978-1-61-600468-2, 300 pages. Available from the MU Bookstore (\$ 29.95), or as e-book from Amazon (\$ 8.95).

Self-check questions and recorded videos of the lectures are included in the online content of each lesson

INSTRUCTOR INFORMATION

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Virtual office hours: I will be online on Wednesday from 1-3 pm CST (Missouri time). During those times I will be online, monitoring email and will respond immediately to any emails that you send to me. At other times, please allow 24 hours for a response during weekdays. Email response during weekend will be sporadic at best. For the quickest response, send your email using our blackboard website.

PREREQUISITES AND TECHNICAL REQUIREMENTS

This course does not have any prerequisites. As to technical skills, you must be able to convert whatever format you do your projects on to .pdf format or .doc and .docx format. Other formats cannot be scanned for viruses and will not be accepted.

Some of the lectures will be delivered using Tegrity videos as support. To watch a Tegrity video, you will be prompted to install the Tegrity Viewer. If you have any trouble, please consult the Tegrity Student Help Guides (see link below) or call the Help Desk, 882-5000.

<http://etopics.missouri.edu/categories/Student+Help/Digital+Media/Tegrity/>

Since this is an online course, you are expected to have a suitable connection that does not break down five minutes before the deadline.

COURSE OBJECTIVES

While every week has its individual learning objects, globally speaking by the end of the course you should be able ...

- To describe what the Universe is and what its contents are (week 2)
- To relate the contents of the Universe to its origin (week 2)
- To explain how galaxies form because of the force of gravity (week 3)
- To explain how a solar system can form from a molecular cloud (week 4)
- To describe what objects form in a solar system besides a star (week 4)
- To explain what makes a star shine and the role that the fundamental forces play in it (week 5)
- To describe what the connection is between the size of a star and its temperature and lifespan (week 5)
- To explain how black holes, neutron stars and white dwarfs can result from the death of a star (week 5)
- To identify the differences between terrestrial planets and gas giants (week 6)
- To explain why gas giants grew to be larger than terrestrial planets (week 6)
- To describe how we can detect planets circling other stars (week 6)
- To describe what we have discovered about the moons in our solar system (week 7)
- To explain why moons always show the same side to a planet (week 7)
- To describe the smaller bodies that are present in our solar system (week 8)
- To identify asteroids and comets and explain the differences between them (week 8)
- To make astronomical observations and draw scientific conclusions from them (Sunset and Moon projects, week 1-7)
- To interpret scientific data and draw conclusions from them (Exoplanet project, weeks 6-7)

COURSE EXPECTATIONS AND STUDYING

PARTICIPATION

- ***What to Expect from a Technology-Enhanced Course*** - This course is designed to meet virtually. It is essential that you access the course site Monday through Friday for course announcements, submit assignments, take online quizzes, etc.
- ***What to Expect from an 8 week course*** – You will discover that it is very easy to fall behind and almost impossible to catch up. So plan your week and summer with plenty of time reserved for this course.
- ***What You May Expect from the Instructor*** – I will respond to private questions within 24 hours (Monday through Friday), provide timely feedback on written assignments and projects, and help build a learning community.
- ***What to expect when illness interferes*** – I will always try to work around illnesses and other emergencies, but you will have to let me know as soon as it happens. I cannot do anything once too much time has passed

Here are a few suggestions to follow when preparing your progress evaluation assignments (aka quizzes) and studying for and taking exams:

- While working on your progress evaluations or taking exams, make sure that you read the posed questions carefully. Unfortunately, it is a common trend to give excellent answers to unasked questions. Make sure that you understand what the question is asking before answering it.
- You might want start conducting your Moon observations due at the end of week 7 as soon as you start this course. This activity requires two weeks of naked-eye observations of the Moon and clouds can get in the way of your schedule.

GRADE SCALE

Grade	Percentage
A+	92-100
A	88-92
A-	84-88
B+	80-84
B	76-80
B-	72-76
C+	68-72
C	64-68
C-	60-64
D+	56-60
D	52-56
D-	50-52
F	0-50

GRADING POLICY

Late Work Policy: Late quizzes and exams cannot be accepted as the answers will be made available as soon as the deadline has passed. Late projects will be accepted, but the grade will be lowered by 25% for each day that it is late.

Grades will be based on a weighted average of the following:

Assignments	Point Total
Weekly Quizzes → 7 weeks x 50 points each week	350 points
Midterm exam	200 points
Final exam	200 points
2 observational projects on the Sun and the Moon (50 + 100 points, resp.)	150 points
1 lab project on exoplanets	100 points
Total	1000 points

Each category is described in more detail below.

WEEKLY QUIZZES

You will have 7 quizzes, given at the end of week 2 through 8, worth 50 points each (5% of your grade). Each quiz will consist of 8 multiple choice questions and 1 essay question and you have 1 hour to complete it.

MIDTERM AND FINAL EXAM

You will have to complete 1 midterm and 1 final exam. Each exam consists of a combination of multiple choice and essay questions. Each exam will have a 2 hour time limit, and it is open book.

PROJECTS

There are 3 projects that account for the 1 lab credit hour. The Sunset and Moon observational projects require repeated observations over the course of weeks and should be planned well in advance of the due date. The Exoplanet project can be completed without going outside.

LESSONS AND PROJECTS SUMMARY

Week 1: familiarization with course layout and 2 observational projects.

Project 1: Sunset observations (activity). In this project students will observe a number of sunsets, and compare the colors of the Sun and sky and the shape of the setting Sun, and relate these observations to atmospheric conditions.

Project 2: Moon observations (activity). This is an observational project in which students will conduct a two-week long observation of the Moon. They will learn how to measure the sky using their hands, how to determine the position of an object in the sky. In this activity students will demonstrate their understanding of the Moon phases.

Week 2: The Birth of the Universe. This lesson is an introduction to cosmology. It discusses the origins of our Universe and how energy became matter that clumped together and ultimately formed stars and galaxies.

Week 3: Galaxies. In this lesson we will talk about galaxies, their formation and evolution as well as their shapes, structures and composition. In order to understand how our own Milky Way galaxy and other galaxies formed, students will be introduced to the concepts of gravity, conservation of angular momentum, and to the connection between electrons and light.

Week 4: Formation of the Solar System. In this lesson we will discuss what is known today about our Solar System: from its origin to its current state. Students will learn the topology of the Solar System as well as its chemical make-up and dynamics. Students will learn how a cloud of gas and dust collapsed and formed a star with its planets, moons, asteroids, comets, and other tiny bits of matter that are still here today. To fully understand this process and its relationship to life-friendly environments, students will have to understand how temperature, density, gravity, and angular momentum work together.

Week 5: The Stars. This lesson explains what stars really are: how they are born, what makes them shine; students will learn how the mass of a star determines everything about it, from its luminosity to how long it will last for. Students will learn about stellar corpses: white dwarfs, neutron stars and black holes. Also, in this lesson students learn more about the properties of light.

Midterm Exam (covers weeks 1-5 and project 1)

Week 6: Planets. The purpose of this lesson is to learn about the eight planets in our Solar System: we will learn what makes these eight worlds alike and what gives them their unique characteristics. In this lesson we concentrate on the two classes of the planets (rocky and gas giants) and their physical characteristics. Also, we will discuss their internal structures and appearances, and we will have a look at the newly discovered exoplanets: planets that orbit a star other than our Sun.

Project 3: Exoplanets (lab activity). The purpose of this activity is to learn how exoplanets are detected, and how their orbital characteristics and (sometimes) physical characteristics can be determined from the light that reaches us from the star around which the exoplanets are orbiting. Students will use Kepler telescope data to determine the orbital characteristics of some transiting exoplanets.

Week 7: Moons. In this lesson students will learn about the satellites of the planets: the moons. There are more moons in our solar system than we have room to describe, but we will 'visit' thirteen of them and look at their appearance and composition, paying special attention to the possibility that liquid water might exist on them. We will also scrutinize our Moon, from its likely origin to the phases it displays in the sky, and the eclipses it causes and undergoes.

Week 8: Smaller Bodies. In this lesson students will learn about the smaller objects that are part of our solar system: dwarf planets, asteroids, comets, centaurs and meteoroids. They will learn why Pluto is no longer considered a planet, but rather is a member of a new class of objects: the dwarf planets. Students will learn about asteroids and comets, and how impacts not only changed the course of evolution here on Earth, but also how they delivered information about the formation of our solar system.

Final Exam (covers Week 6-8 and projects 2 and 3)

RESOURCES

Library resources: Access to the library will be critical to your academic success in general. You may access the University of Missouri Library Distance Education Support Service page at: <http://mulibraries.missouri.edu/distance/>. For instance, our library has many astronomy textbooks, so if you wish

to read about the same material but presented in a different way, or you wish to learn more about a particular topic, our library will more likely than not have the materials you are looking for.

Student services: issues may come up during the semester that might not necessarily be linked to the course, but it would still be nice to have them resolved. Likely MU's student services can help: missouri.edu/students.

Discussion board: your peers are often your best source for help as they can very well have been pondering similar questions. There is a discussion board dedicated to posting any course related questions. Note that there are no required discussion board postings in this course.

TEGRITY INFORMATION

MU has implemented the Tegrity Lecture Capture System. The system allows us to record and distribute lectures and other audio and video recordings to you in a secure environment through Blackboard. No material should be shared with individuals outside of your class, or faculty and staff who require access for support or specific academic purposes without permission.

You may watch recordings online, or download them for off-line viewing on your computer, smartphone, or media player. The Curators of the University of Missouri and your instructor jointly copyright these recordings. Posting them to another website, including YouTube, Facebook, BlipTV, or any other site without express, written permission may result in disciplinary action and possible civil prosecution.

To watch a Tegrity video, you will be prompted to install the Tegrity Viewer. If you have any trouble, please consult the Tegrity Student Help Guides (see link below) or call the Help Desk, 882-5000.

<http://etopics.missouri.edu/categories/Student+Help/Digital+Media/Tegrity/>

ACADEMIC INTEGRITY POLICY

The following is our University's policy. Please read carefully. The bottom line is this: if you pass off other people's work as your own, you will face serious consequences both in terms of your grade, and in terms of the mandatory reporting to the Office of the Provost.

ACADEMIC INTEGRITY POLICY

Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

Academic Dishonesty includes but is not necessarily limited to the following:

- A. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty.
- B. Plagiarism which includes but is not necessarily limited to submitting examinations, themes, reports, drawings, laboratory notes, or other material as one's own work when such work has been prepared by another person or copied from another person.
- C. Unauthorized possession of examinations or reserve library materials, or laboratory materials or experiments, or any other similar actions.

- D. Unauthorized changing of grades or markings on an examination or in an instructor's grade book or such change of any grade report.

Academic Integrity Pledge: *"I strive to uphold the University values of respect, responsibility, discovery, and excellence. On my honor, I pledge that I have neither given nor received unauthorized assistance on this work."* Students are expected to adhere to this pledge on all graded work whether or not they are explicitly asked in advance to do so.

The University has specific academic dishonesty administrative [procedures](#). Although policy states that cases of academic dishonesty must be reported to the Office of the Provost for possible action, the instructor may assign a failing grade for the assignment or a failing grade for the course, or may adjust the grade as deemed appropriate. The instructor also may require the student to repeat the assignment or to perform additional assignments. In instances where academic integrity is in question, faculty, staff and students should refer to [Article VI of the Faculty Handbook](#). Article VI is also available in the [M-Book](#). Article VI provides further information regarding the process by which violations are handled and sets forth a standard of excellence in our community.

NON-DISCRIMINATION, DISABILITIES, INTELLECTUAL PLURALISM AND GRIEVANCES

UNIVERSITY OF MISSOURI NOTICE OF NONDISCRIMINATION

The University of Missouri System is an Equal Opportunity/ Affirmative Action institution and is nondiscriminatory relative to race, religion, color, national origin, sex, sexual orientation, age, disability or status as a Vietnam-era veteran. Any person having inquiries concerning the University of Missouri's compliance with implementing Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, the Americans With Disabilities Act of 1990, or other civil rights laws should contact the Assistant Vice Chancellor, [Human Resource Services](#), University of Missouri, 1095 Virginia Avenue, Columbia, Mo. 65211, 573/882-4256, or the Assistant Secretary for Civil Rights, U.S. Department of Education.

STUDENTS WITH DISABILITIES (RESIDENTIAL & ONLINE COURSES)

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the Office of Disability Services (<http://disabilityservices.missouri.edu>), S5 Memorial Union, 573- 882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.

INTELLECTUAL PLURALISM STATEMENT

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director of the [Office of Students Rights and Responsibilities](#) (<http://osrr.missouri.edu/>). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

GRIEVANCE POLICY

Information concerning student grade appeal procedures and non-academic grievances and appeals may be found in the Student Handbook.