Term Information

Effective Term	Spring 2025

General Information

Course Bulletin Listing/Subject Area	Astronomy
Fiscal Unit/Academic Org	Astronomy - D0614
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2020
Course Title	The Night Sky
Transcript Abbreviation	Night Sky
Course Description	This course uses the planetarium and observations of the sky to understand the motion of the Sun, Moon, and planets, and how humans have interpreted them. It considers the large number of foreign worlds that have been discovered orbiting the Sun and other stars, and visualizes their skies. It reflects on how the night sky affects human cultures, and how it might affect cultures on other worlds.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark

Prerequisites and Exclusions

Prerequisites/Corequisites	None.
Exclusions	Not available for credit if student has taken Astronomy 1140 or 2140
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0201
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

Lived Environments

Course Details

Course goals or learning objectives/outcomes

- 1. Students appreciate how our view of the sky changes throughout the day, month, and year and in polar, temperate, and tropical locations.
- 2. Students connect the view of the sky with different cultural practices and traditions.
- 3. Students understand how positions and motions of celestial objects in the night sky influence timekeeping and navigation on Earth.
- 4. Students recognize the profound transformation in our understanding of humanity's centrality to the Universe from the geocentric theory to the heliocentric theory to the 'one of billions of galaxies" view.
- 5. Students understand and apply universal physical laws for motion, gravity, and light to other solar system bodies and exoplanets.
- 6. Students understand why certain environmental concerns, in particular light pollution, space debris, and location of telescopes, are of high importance to astronomy and the competing concerns of other claims to land and sky.
- 7. Students appreciate that the human body evolved on Earth, with its gravity and day/night patterns, and comprehend the possible challenges to long-term spaceflight, both psychological and physical.
- 8. Students appreciate how we can determine the appearance of the skies from other solar system bodies and planets in other solar systems.
- 9. Students understand the contingency of many aspects of Earth: rotation period, single Sun, large Moon, small tilt to axis, fortuitous placement of North Star and use this to critically evaluate our conventions around time and space.

Content Topic List

- Week 1: Viewing the Sky from Earth; Light Pollution; Constellations; Daily Motions
- Week 2: Annual Motions & the Zodiac; Seasons; Motions & Phases of the Moon
- Week 3: Solar & Lunar Eclipses; Calendars; Motions of the Planets
- Week 4: Size & Shape of Earth; Navigation
- Week 5: The Changing Sky; Comets, Historical Supernovae, and their Interpretations
- Week 6: Ptolemy's Model; Copernicus; Galileo, Tycho, & the Copernican Revolution
- Week 7: Kepler's Laws; Gravity and Tides
- Week 8: The Night Sky on Solar System Worlds
- Week 9: Telescopes on Mountains and in Space; Properties of Light
- Week 10: Revealing the Milky Way as a Galaxy; Discovery of other Galaxies,
- Week 11: Spaceflight, Artificial Satellites, Protecting the Night Sky
- Week 12: Discovery and Properties of Exoplanets; the Architecture of Exo-solar systems
- Week 13: Demographics of Exo-solar systems and Exoplanets
- Week 14: The Night Sky on Exoplanets

Sought Concurrence

No

Attachments

- Astro2020_syllabus.docx: Astronomy 2020 syllabus

  (Syllabus. Owner: Ryden,Barbara Sue)

- submission-lived-environments_Astro2020.pdf: Astronomy 2020 GEN Submission Form

  (Other Supporting Documentation. Owner: Steele,Rachel Lea)

- Astro2020_syllabus_rev.docx: Revised Astronomy 2020 syllabus

  (Syllabus. Owner: Ryden,Barbara Sue)

- Response to subcommitte -- Astronomy 2020.docx: Response to comments by subcommittee

  (Cover Letter. Owner: Ryden,Barbara Sue)

Comments

- Revised syllabus, and response to the comments of the subcommittee, are attached. *(by Ryden,Barbara Sue on 04/23/2024 09:56 AM)*
- Please see NMS Subcommittee feedback email sent 4/15/24. *(by Neff,Jennifer on 04/15/2024 10:14 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Ryden,Barbara Sue	03/22/2024 02:57 PM	Submitted for Approval
Approved	Weinberg,David Hal	03/26/2024 07:08 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	03/26/2024 09:43 AM	College Approval
Revision Requested	Neff,Jennifer	04/15/2024 10:14 AM	ASCCAO Approval
Submitted	Ryden,Barbara Sue	04/23/2024 09:56 AM	Submitted for Approval
Approved	Weinberg,David Hal	05/10/2024 12:02 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	05/10/2024 12:35 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	05/10/2024 12:35 PM	ASCCAO Approval

We thank the subcommittee for their feedback and have adjusted the syllabus accordingly. In more detail:

"Comment: The Subcommittee notes that there is a statement in the syllabus above the Theme Goals and ELOs that references the GEC, which is an old general education program that the university no longer operates on. The Subcommittee recommends that the department remove this statement altogether as it is not necessary to include in the syllabus. [Syllabus p. 9]"

Response: Sentence removed

"Contingency: The Arts and Sciences Curriculum Committee recently (03-01-2024) updated the list of required syllabus statements for all syllabi to include a new statement on religious accommodations. The new version of this required statement is a result of a directive by the Executive Vice President and Provost and can be found here on the ASC Curriculum and Assessment Services website. Please note that the link to religious holidays, holy days and observances at the end of the statement is also required to be included in the syllabus The Subcommittee thanks you for adding this revised statement to your course syllabus. [Syllabus p. 8]"

Response: religious accommodation statement updated

"Recommendation: The Subcommittee recommends that the department include a technology statement in the syllabus making it clear that students are required to have a camera of some sort in order to complete certain requirements of the course. Along those lines, the Subcommittee wonders if a cell phone camera without a solar filter will suffice without damaging its sensor and recommends addressing this in the syllabus if necessary. "
Response: A "Technology Requirements" section has been added on page 7, right after the textbook information. We discuss the need for a camera, what to do if a student does not have access to one, and what a student should do if they are concerned about the effect of imaging the Sun on their camera. We note that the main assignment for photographing the Sun involves snapping pictures of sunsets, where the Sun is low enough in the sky so that camera damage is not a concern.

- Jennifer Johnson

Astronomy 2020: The Night Sky

Overview

Astronomy is an ancient practice. Since prehistoric times, humans have used the sky for both creative and practical purposes, such as timekeeping, navigation, divination, and storytelling. The exploration of the sky has also revealed our true place in the Universe, as one of many planets circling one of many suns in one of many galaxies. In modern industrial times, human have altered our interaction with the sky through artificial lighting, satellite constellations, and voyages into space and to other worlds.

In this course, we will use the capabilities of the planetarium as well as actual observations of the sky to understand the apparent and real motions of the Sun, Moon, planets, and stars and how humans have interpreted and used them. We will demonstrate how we learned that the Earth is not the center of the Universe and that the Milky Way is not the only galaxy. We will consider how the nature of gravity and light makes the skies on other solar system bodies different from our own. We have begun to see these other skies through both human and machine visits. We will consider how humans have responded to leaving the Earth and its familiar horizons. We will learn about the large number of even more foreign worlds that have been discovered around other stars and visualize their skies. Finally, we will reflect on how the night sky on Earth has affected our cultures by imagining other cultural traditions that could arise on exoplanets.

Instructor:

Office:
Phone:
Email:
Office Hours:

Meeting Time:

Classroom: Planetarium (Smith 5033)

Format: 3 contact hours per week, lecture format with in-class exercises, discussions, and questions.

GEN Themes: Lived Environments

Not available for credit if student has taken 1140 or 2140.

Topical Outline

The following topics will be covered in this class, by week. More details on homework and quizzes found in subsequent sections.

Section 1: Interpretating the Night Sky

We begin our exploration of the sky by examining how humans have perceived and represented the sky through constellations, the North Star, the Milky Way, and archeoastronomy sites. Using the planetarium, we will view the sky from polar, temperate, and tropical locations and discuss how cultures have elevated the importance of different astronomical events. We discuss how our interactions with the sky have shaped our understanding and marking of time, our ability to navigate across the world, and our beliefs of the connection between celestial and human events. We explore Western conventions of time and place, comparing choices based on natural rhythms to those of arbitrary nature. The impact of light pollution in lessening the ubiquity of the night sky and its cycles and possible mitigation is discussed.

Week 1: Viewing the Sky from Earth; Light Pollution; Constellations; Daily Motions

Week 2: Annual Motions & the Zodiac; Seasons; Motions & Phases of the Moon,
Reading: *Empires of Time:* Chapter 2, "Early Time Reckoning," pp. 33-74
Homework #1 due
In this homework, you will engage directly with the question of the different perceptions of the night sky by different human cultures using the unique constellations of e.g., the Greek, Chinese, ancient Egyptian, Sami, Australian Aboriginal, and Ojibwe peoples. The homework is complemented by reading about how ancient peoples recorded time using the appearance of constellations in the sky, the phases of the moon, and sites such as Stonehenge.

Week 3: Solar & Lunar Eclipses; Calendars; Motions of the Planets
Reading: *Empires of Time:* Chapters 3, part of Chapter 4, "The Western Calendar" and "The Year and Its Accumulation in History", pp. 75-128
Homework #2 due
In this homework, you will answer questions about the Western calendar and how it came to have its present form. Critical complexities to be highlighted include the difference between the Julian and Gregorian calendars, the importance of the date of Easter in Christianity, and keeping track of time over long periods.

Week 4: Size & Shape of Earth; Navigation
Reading: *Empires of Time:* Chapters 5, 6, and 9, "Tribal Societies and Lunar-Social Time," "The Interlocking Calendars of the Maya," "Eastern Standard: Time Reckoning in China," pp. 147-225, 271-289
Homework #3 due
In this homework, we complete our cross-cultural exploration of the intersection between observations of the night sky and timekeeping. You will answer questions about the difference between the Nuer, Mayan, and Chinese conventions of timekeeping compared to the Western calendar.

Week 5: The Changing Sky; Comets, Historical Supernovae, and their Interpretations
Quiz 1 due

Section 2: From Geocentric to Heliocentric

Humanity's belief of our place in the cosmos is intimately tied to whether the Earth is the center of the Universe or one planet among many. Here we will describe the rationale and consequences of the Earth-centered model, the observations that began to overturn its philosophical underpinning, and the ultimate realization of the multitude of stars and planets. Following this rearranging of the Universe came a re-synthesis in the universal physical laws and the theory of planetary motions. We will use these universal laws to understand how solar systems worlds can orbit and spin at very different rates and examine what this means for their night skies.

Week 6: Ptolemy's Model; Copernicus; Galileo, Tycho, & the Copernican Revolution
Reading: *Coming of Age in the Milky Way*, Chapters 1-5 : "The Dome of Heaven," "Raising (and Lowering) the Roof," "The Discovery of the Earth," "The Sun Worshippers, "The World in Retrograde," pp. 19-102
Homework #4 due

In this homework, you will learn and answer questions about the geocentric model and the role of the ancient Greek adoration of geometry in its development. Alternative heliocentric models were present at the same time, but were not the dominant paradigm until Copernicius' resurrection of them coincided with the observations of Galileo. We will examine how Galileo's use of a new technology to explore the sky, the telescope, was crucial in the switch from geo- to helio-centric way of thinking about our place in space.

Week 7: Kepler's Laws; Gravity and Tides

Reading: *Coming of Age in the Milky Way,* Chapters 6-7: "Newton's Reach," "A Plumb Line to the Sun," pp. 103-142

Homework #5 due

In this homework, you will answer questions about how Newton developed his laws of motion and universal gravitation and their ongoing impact. Among them was the discovery of the true scale of the solar system by measuring the distance to Venus and using Newton's laws. The large-scale human endeavor to observe the eighteenth-century transits of Venus from across the globe represented a change in thinking about our power to learn about the Universe.

Week 8: The Night Sky on Solar System Worlds

Quiz 2 due

Section 3: Technology and the Night Sky

Galileo's telescope was just the beginning of using technology to observe space. We will discuss how telescopes are used to extend human vision and discover that our Milky Way is just one of many galaxies, reducing our place in the cosmos even more. We will discuss the astronomical reasons to prefer isolated mountain tops and how that desire conflicts and interacts with other uses of mountain tops. We will discuss the impact of human-created light pollution and the Earth's atmosphere on our ability to probe the faintest objects. Our ability to send artificial satellites and telescopes into space has opened up new vistas, but creates increasing concerns about space debris and "ownership" of space, that makes a universal space policy of ever increasing concern.

Week 9: Telescopes on Mountains and in Space; Properties of Light

Homework #6 due

In this homework, you will re-engage with the details of the sky and identify the impact of light pollution on your view of the night sky. You will observe the changing position of the setting Sun as it moves toward solstice or equinox. You will observe the Moon at different points in the month and understand how the patterns of its phase and position in the sky are interpreted in terms of the Earth-Sun-Moon positions.

Week 10: Revealing the Milky Way as a Galaxy; Discovery of other Galaxies,

Reading: *Coming of Age in the Milky Way,* Chapters 8-9: "Deep Space", "Island Universes," pp.143-176

Homework #7 due

In this homework, you will answer questions about how we learned the true size of the Milky Way and that, however vast, it is still only one among many. The importance of improving telescope technology and dark skies forms a critical part of this transformation. These readings will highlight the change in perception over the size of our Universe from the geocentric model to the present day.

Week 11: Spaceflight, Artificial Satellites, Protecting the Night Sky

Reading *Packing for Mars,* Chapters 1-6: pp. 21-122

- "He's Smart but His Birds are Sloppy: Japan Picks an Astronaut"
- "Life in a Box: The Perilous Psychology of Isolation and Confinement"
- "Star Crazy: Can Space Blow Your Mind?"
- "You Go First: The Alarming Prospect of Life Without Gravity"
- "Unstowed: Escaping Gravity on Board NASA's C-9"
- "Throwing Up and Down: The Astronaut's Secret Misery"

Homework #8 due

In this homework, you will answer questions about how humans react, both psychologically and physically, to spaceflight. You will learn about how much the human body depends on gravity for certain functions and how "zero-g" test flights have been used to explore the impact. The possible psychological effects of long-term spaceflight are highlighted. There are experiments underway to understand humans' reaction to true confinement and lack of Earth-view.

Section 4: Other Worlds, Other Skies

To truly explore how much of the contours of human life are bound up in our particular solar system, it is important to consider other solar systems and what beliefs, attitudes, or behaviors we might have adopted if Earth had been similar to planets we have found around other stars. We start by introducing examples of these systems, including planets in binary star systems, planets that are tidally locked to their stars, planets on very elliptical orbits, planets in dense star clusters, and planets that are misaligned with other planets in their systems. Applying our knowledge of the universal physical laws, we will understand how these planets move and what their skies will look like. We will use the planetarium to visualize the skies on these worlds. Finally, we will consider how these skies would prompt different cultural adaptions to the ones we have on Earth.

Week 12: Discovery and Properties of Exoplanets; the Architecture of Exo-solar systems

Reading: *The Planet Factory,* Chapters 7 and 9-11 pp. 119-142, 165-226

- "Water, Diamonds or Lava? The Planet Recipe Nobody Knew"
- "The Lands of Two Suns"
- "The Planetary Crime Scene"
- "Going Rogue"

Quiz 3 due

In this reading, lively descriptions of the kind of exo-planets that we have discovered are given, which will form the basis for thinking about culture on these planets.

Week 13: Demographics of Exo-solar systems and Exoplanets

Reading: *The Planet Factory,* Chapters 12-15 pp. 227-289

- "The Goldilocks Criteria"
- "The Search for Another Earth"
- "Alien Vistas"
- "Beyond the Goldilocks Zone"

Homework #9 due

In this homework, you will answer questions about the kinds of exoplanets that we have discovered, how we have discovered them, and how we know that they have non-Earth-like characteristics. You will see how we can use the physical laws of gravity and light will be used to predict their properties.

Week 14: The Night Sky on Exoplanets

Homework #10 due

In this concluding assignment, you will place yourself outside of the solar system in another solar system and imagine how timekeeping, important astronomical dates, seasons, or other traditions would be different than on Earth. You will reflect on how much of your worldview of how time, space, and the sky should work is tied to your specific Earth-bound environment.

Class Participation & Attendance

Attendance is required, as the immersive planetarium experience is a critical part of the course and cannot be duplicated. Each class will feature at least one in-class exercise to promote active learning. Discussion with your classmates is encouraged (and sometime required). In many cases, there will be no right answers. If there are right answers (for example, when we determine the current height of the Sun) you will have as many opportunities as you would need to get the right answer. You can also ask the professor or TA for help. There will be at least 40 points available to earn for in-class exercises. However, the maximum points that count towards your grade is 28. Therefore, you can still have full class participation points even if you must miss a class. Make-up opportunities are not available for the in-class exercises, but the exercises will be available on Carmen for your reference.

Homework

Homework will be assigned at regular intervals, with a total of 10 assignments during the semester. The two lowest-scoring homework grades from Homeworks 2-5 and 7-9 will be dropped. The eight highest-scoring homework scores will count for 32% of your grade. Homework must be submitted on Carmen by the start of class on the due date.

Homework will be ~ 2 page responses (Assignment 1 and 10), a photographic record and discussion of observations of the Sun and Moon and night sky (Assignment 6) or ~12 multiple-choice questions based on readings.

Homework Assignments

Homework 1: Choose a part of the sky among the options given (e.g., the area of the North Celestial Pole; Orion and Sirius; Scorpius) or an option selected with approval from the professor. Write a 2-page essay discussing how at least 3 cultures have viewed and mapped this part of the sky and how their choices reflect their environment and beliefs. A list of resources to get you started is provided on Carmen.

For homework assignments with reading, please complete the associated quiz on Carmen after you complete the reading.

Homework 2: Answer questions based on *Empires of Time:* Chapters 2-3, Chapter 4 through the start of "Evolutionary Time."
Homework 3: Answer questions *Empires of Time:* Chapters 5, 6, and 9
Homework 4: Answer questions based on *Coming of Age in the Milky Way*, Chapters 1-5
Homework 5: Answer questions based on *Coming of Age in the Milky Way,* Chapters 6-7

Homework 6: Observations of the Moon and Sun and Sky

Note: The due date for this assignment is 2 months into the semester, but you should begin it as soon as possible, as there may be many cloudy days and nights in a row in Ohio. Some clouds are fine, but I should be able to see the Sun/Moon in your pictures.

Take at least 3 photos of the Sun at sunset from the same position on campus, separated over at least a month. Please find a place with a clear view of the western horizon (such as the upper floors of Thompson Library). You can find sunset times at websites such as https://www.timeanddate.com/sun/ if that helps your planning. Mark due west on all images and describe how the location of sunset changes with time.

Take at least 3 photos of the Moon, including one during the day, and separated by at least two weeks. Indicated the direction of the Sun (Sun doesn't have to be in the picture) on each image and name the phase of the Moon. Describe briefly how the rise and set times of that Moon phase confirm that it should be above the horizon at that time.

Please upload 1 document to Carmen with your photos of Sun and Moon labeled with date and location as well as the other information requested.

Download the Light-Pollution Measuring App (Dark Sky Meter for iPhone or Loss of the Night for Android). On a clear night(s), go to two locations in Columbus with different light pollution, such as a very bright location (near the Shoe, near North Tower, etc) and a bright location (in the middle of the Oval, blocks from campus away from streetlights, etc). Measure and record the light pollution at the two locations using the app. Count and record the approximate number of stars you can see. Write a paragraph describing how your view of the night sky is affected. For example, can you see enough stars to find any constellations? Are there stars near the Moon (if up) or the planets?

Please upload your measurements, star counts, and paragraph in 1 document to Carmen.

Homework 7: *Coming of Age in the Milky Way,* Chapters 8-9
Homework 8: *Packing for Mars,* Chapters 1-6
Homework 9: *The Planet Factory,* Chapters 7 and 9-17

Homework 10: In class and in your reading, you have encountered exoplanets that are quite different than Earth (e.g., planets on very elliptical orbits, tidally locked planets, planets that orbit binary stars, planets in resonance with other planets, and waterworlds). Inspired directly by such planets, please write a 2-page essay describing **one** cultural tradition, ritual, art form, or other cultural response that a civilization present on that planet or colonizers from Earth could create in response to living on such a planet. Please pick a property or occurrence on the planet that is **not** found on the Earth. A wonderful example of this is described in the opening page of *2132* by Kim Stanley Robinson, which we will discuss in class.

Required Readings:

Empires of Time: Calendars, Clocks, and Cultures by Anthony Aveni
Coming of Age in the Milky Way by Timothy Ferris
Packing for Mars by Mary Roach
The Planet Factory: Exoplanets and the Search for a Second Earth by Elizabeth Tasker

The books for the required readings can be obtained from the bookstore, on sites such as Amazon, and on 2-hour reserve at the 18th Ave Library. If you purchase them used online, the total should come to less than $25.

Supplementary Textbook:

OpenStax Astronomy by Fraknoi, Morrison, Wolff: https://openstax.org/details/books/astronomy
This free e-book provides an additional resource for the ideas discussed in lecture.

Technology Requirements:
All assignments will be submitted on Carmen, including in-class assignments. If students do not have or forget to bring a laptop/iPad/smartphone or other connected device to class, there will iPads available for their use. To complete a few of the assignments in this class, a camera (smartphone, iPad, or actual camera are all acceptable) is needed. If a student does not have a camera available, please talk to the professor to arrange to use one of the class iPads.

Taking pictures of sunsets will not harm cameras, as the sunlight travels through enough atmosphere to be heavily diminished. Pictures of the Sun higher in the sky to show its position relative to the horizon/zenith may be requested as part of the in-class assignments. While a single picture of the Sun should not harm most cameras, students who are concerned may use one of the class iPads to take pictures. (Note: Solar filters are not appropriate when capturing the Sun in context to the sky and land, because the Sun is the only thing that visible through solar filters.)

Quizzes and Final Exam

Study guides for the quizzes will be posted online the week before the quiz. You will have the full class period to take the quiz. There will be approximately 40 questions on each quiz. The quizzes will focus on the material in the lectures and readings since the previous quiz. The quizzes will be multiple choice and taken through Carmen. The quizzes are open-book and open-note. **Exams should be the work of the student alone.** Please do not ask others for help.

Make-up Quizzes: If you cannot take the quiz on the schedule date, please let me know ASAP and we will arrange an alternative, such as an extended deadline or taking the quiz early. Note that make-up quizzes may be in a different format than the regular quizzes, such as an oral exam instead of multiple-choice questions.

Each quiz is worth 10% of your final grade.

The final exam will have a similar arrangement, except there will be approximately 100 multiple-choice questions and you will have 105 minutes. The final will be cumulative, covering all topics in the course. If you do not take the final exam and you have not contacted me, you will receive a zero on the final exam and your grade will be calculated on that basis. This is necessary so that I can submit everyone's grades in a timely manner. If you have an emergency, please let me know ASAP and we will make arrangements, such as taking an Incomplete.

The final exam is worth 10-20% of your final grade

Trade Off between Quizzes and Final
Your final course grade will be the higher of:

- Counting the three quizzes as 30% of your grade and the final as 10%
- Counting the two highest scoring quizzes as 20% of your grade and the final as 20%

I will calculate both scores and assign you the higher grade.

Summary of Grading Policy

- The eight highest-scoring homework assignments account for **32%** of your grade.
- Class participation, from the total score on your in-class exercises up to a maximum of 28 points, accounts for **28%** of your grade
- The three quizzes account for **30%** of your grade, or the two high-scoring quizzes account for **20%** of your grade
- The final exam accounts for 1**0%-20%** of your grade, depending on your quiz scores.
- The quizzes, homework, and final exam scores are not curved.

Academic Integrity

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. To maintain the integrity of the academic process, we are adopting the following policies for this course:

- **Exams:** You must complete the exams yourself, without any external help or communication, or use of unapproved sources.
- **Homework and In-Class Assignments:** Your written assignments should be your own original work. While you are encouraged to work in study groups, even if an answer to a question is developed as a group, you must write the final answer down in your own words.
- **Reusing past work:** In general, you are prohibited in university courses from turning in work from a past class for your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with the professor first.

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct **http://studentlife.osu.edu/csc/**.

Religious Accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious

beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity.

Students with Disabilities

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the **Safe and Healthy Buckeyes site** for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at **slds@osu.edu**; 614-292-3307; or **slds.osu.edu**.

Mental Health Resources

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic

performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

General Education Learning Goals & Outcomes

Goals:

1. Successful students will analyze an important topic or idea at a more advanced and in-depth level than in the Foundations component. [Note: In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.]

2. Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

3. Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g., agricultural, built, cultural, economic, intellectual, natural) in which humans live.

4. Successful students will analyze a variety of perceptions, representations, and/or discourses about environments and humans within them.

Expected Learning Outcomes:

Successful students are able to:

1.1. Engage in critical and logical thinking about the topic or idea of the theme.

1.2. Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.

2.1. Identify, describe, and synthesize approaches or experiences as they apply to the theme.

2.2. Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.

3.1. Engage with the complexity and uncertainty of human-environment interactions.

3.2. Describe examples of human interaction with and impact on environmental change and transformation over time and across space.

4.1. Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values, and behaviors.

4.2. Describe how humans perceive and represent the environments with which they interact.

4.3. Analyze and critique conventions, theories, and ideologies that influence discourses around environments.

Specific learning objectives for Astronomy 2020 (The Night Sky)

1. Students appreciate how our view of the sky changes throughout the day, month, and year and in polar, temperate, and tropical locations.
2. Students connect the view of the sky with different cultural practices and traditions.
3. Students understand how positions and motions of celestial objects in the night sky influence timekeeping and navigation on Earth.
4. Students recognize the profound transformation in our understanding of humanity's centrality to the Universe from the geocentric theory to the heliocentric theory to the 'one of billions of galaxies" view. They understand the scientific arguments that informed these views and follow the application of the scientific method to these discoveries.
5. Students understand and apply universal physical laws for motion, gravity, and light to other solar system bodies and exoplanets.
6. Students understand why certain environmental concerns, in particular light pollution, space debris, and location of telescopes, are of high importance to astronomy and the competing concerns of other claims to land and sky.
7. Students appreciate that the human body evolved on Earth, with its gravity and day/night patterns, and comprehend the possible challenges to long-term spaceflight, both psychological and physical.
8. Students appreciate how we can determine the appearance of the skies from other solar system bodies and planets in other solar systems.
9. Students understand the contingency of many aspects of Earth: rotation period, single Sun, large Moon, small tilt to axis, fortuitous placement of North Star and use this to critically evaluate our conventions around time and space.

How this course meets the GEN ELOs:

This course will explore at a deep level the connections between human society and the sky. The sky has influenced culture and been a repository for human lore for all humans. The patterns and motions of the sky have been used by humans to tell time and navigate, skills that made possible the exploration of the Universe. By an in-depth comparison of cultures, we can distinguish what is universal and what is arbitrary in conventions of time and space. This clarifies what in our day-to-day lives is directly influenced by or grew out of astronomical observations and helps us reflect on other options for a society. The study of the sky has helped define our place in the Universe, first as a counterpart to the earth, then as an increasingly vast space that has shrunk humanity's role to insignificance. By using critical and logical thinking, we can understand how our view of the Universe has changed as observations, especially those fueled by technological advances, have been recorded. However, technological changes have also led to increasing light pollution, disconnecting us from regular views of the night sky, to conflicts over land uses for astronomy vs. other claims, and to concerns about how space beyond Earth is to be used. Humans' perception of the sky also changed as universal laws of motion, gravity, and light were developed, creating the ability to understand nature from afar. We can

then conceive how the night skies on bodies beyond Earth would appear and reflect on how that could change our Earth-adapted culture.

GE Theme course submission worksheet: Lived Environments

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Lived Environments)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

Observations of the sky have influenced all human cultures. The cycles in the sky determine our timekeeping, the positions of objects help us navigate, and the patterns we see in the sky are ascribed culture meaning. The changing sky, whether caused by eclipses, comets, or supernovae, have influenced civilizations profoundly. Through imagination and reasoning across several cultures, we have used observations of the night sky to determine our place in the Universe.

Humans, in turn, are changing our relationship with the sky by our increasing reliance on artificial lighting and timekeeping. Finally, we will consider how the unique environments that humans use to explore the night sky: high mountain tops and crewed spaceflights in particular, interact with other conceptions of these locations.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking.	The lectures, readings, in-class exercises and questions require the students to think critically and logically about how humans interact with the sky and celestial objects, how we can understand the nature of the Earth and Universe from our confined view, and how we can learn about the character of other planets and solar systems using observations and the laws of physics. Examples: Lecture: The differences in the sky between polar, temperate, and tropical zones are demonstrated using the planetarium. Students are asked to consider the impact on cultures, including the importance of the summer solstice and the relevance of the winter and summer constellations. Lecture: The differences in determining latitude and longitude are discussed and students will understand why chronometers are an important solution to the longitude problem and the political and social influences on the construction of time zones. Assignments #4, #5, #7: These readings from Coming of Age in the Milky Way describe how we learned that the Earth was not the center of the Solar System and that the Milky Way was not the only galaxy in the Universe. Both conclusions require extensive critical and logical thinking, because it is not self-evident from our position on Earth.

	In-Class Exercise: Students are asked to determine what phases (e.g., full, crescent) the planets in the solar system will have to an Earth observer in a heliocentric and geocentric solar system and compare with observations.
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or ideas within this theme.	Students will engage in advanced exploration of several topics and ideas within the theme. Example: Students will learn about the calendar for different cultures, evaluating what choices in the calendar are imposed by the properties of Earth's motion and what is arbitrary. They will consider the differences among the solar calendar, the lunar calendar, the luni-solar calendar and the Mayan calendar based on the motion of Venus. Example: Students will explore the scientific method at a deeper level by understanding how we reached an understanding that the Sun was the center of the Solar System and that the Milky Way was one of many galaxies. Expanding on the simple story of hypothesis and testing, the lectures and readings will discuss the role of indirect evidence (such as the discovery of Jupiter's moons) and philosophical and aesthetic rationales in addition to direct observational tests. Example: Students will learn subtler effects of gravity beyond the attraction between two masses. In particular, they will learn about tidal forces, which play a crucial role in the appearance of the Moon in the sky, and the concept of "weightlessness" in space and what it means for the human body that has evolved on the Earth.
ELO 2.1 Identify, describe, and synthesize approaches or experiences.	Students will learn about phenomena in the sky using a variety of approaches, including lectures, reading, and in-class demonstrations, exercises, and discussions. They will also be challenged to synthesize these approaches. The lectures use the planetarium to show the night sky at different locations on the Earth and at different times in history. The readings provide deeper cultural and historical background on perceptions of the night sky. The in-class exercises and Homework #6 provide opportunities for students to observe the sky themselves and interpret their observations in light of other learning.
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	The in-class questions and assignments provide regular opportunities for self-assessment, as students can determine how well they understood the material. The in-class exercises become more complex during the semester, as concepts are repeated in novel situations. Examples: In-Class Exercise: The planetarium is used to create the sky at a certain place and time. Students are shown the sky and are asked to determine what time of day it is.

	In-Class Exercise: Students are shown the sky and asked to determine what their latitude is. In-Class Exercise: Students are shown the sky and asked to determine their latitude and longitude. Longitude requires knowing the local time and the time at a standard longitude. Assignment #10 asks the students to combine what they have learned in this course with creative expression by considering what culture could be like on a world very different than ours. This not only emphasizes the ways that exoplanets can be different than Earth, but also encourages the students ponder what about human culture is responsive to the properties of Earth. The exams and homework questions also provide an opportunities for self-assessment about their success in understanding arguments presented in the readings and their synthesis of the material to answer the exam questions.

Goals and ELOs unique to Lived Environments

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g. agricultural, built, cultural, economic, intellectual, natural) in which humans live.

GOAL 4: Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.

	Course activities and assignments to meet these ELOs
ELO 3.1 Engage with the complexity and uncertainty of human-environment interactions.	Students will understand how the view of the sky depends on the latitude, falling into polar, temperate, and tropical regions and how that has impacted the choice of celestial objects for particular attention in a given culture. Students will learn about the construction of calendars and how different cultures have chosen to reconcile conflicting natural cycles, in particular the Moon, the Sun, and the planets. Students learn how to determine the size of the Earth, the size of the solar system, and position of the Earth, Sun, and planets in the solar system even though we are observing vast distances from a moving Earth. Students will learn about psychological well-being concerns for long-range spaceflight when humans are separated from the familiar sky cycles of Earth. Students will envisage how culture might be different on a planet with a different sky.

	The assigned readings for this course explore all these topics in detail, reinforced by planetarium demonstrations.
ELO 3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.	Artificial lightning has transformed humans' relation to the night sky. This will be demonstrated in the planetarium, where we can set different levels of light pollution. An in-class exercise will show reconstructions of dark night skies over famous city landscapes, such as Paris, Rome, and Tokyo and ask the students to reflect on how that could change their experience of that city if they could see the Milky Way arcing across the sky. Homework #6 asks students to measure the light pollution in two different locations in Columbus and discuss how that affects their view of the night sky. The Earth wobbles on its axis and this changes which star is the North Star and which month the Sun is in a certain sign of the zodiac. Students will explore these changes using the ability of the planetarium to show the sky over thousands of years and discuss how human cultures have or have not adjusted to these changes. The practice of astronomy has changed from naked-eye observations available to all to cutting-edge telescopes located in specific environments, such as mountain tops and deserts, that have cultural meaning that can conflict with astronomical uses. Students will learn about why certain environments are crucial for astronomy (above most atmospheric turbulence; away from radio interference) and the importance of these sites from other perspectives.
ELO 4.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.	Humans' experience of the sky shapes many beliefs, values and behaviors. Cultures have attributed immense importance to the motions of the planets through the zodiac, the cycles of Venus, and the conjunctions of Jupiter and Saturn among others. They have constructed religious and civil calendars that impose order on human society. The Aristotlean belief that the Earth was separate from the heavens made the existence of other solar systems inconceivable; the Copernican revolution dethroned the Earth and humanity from the center. More recently, powerful images of the Earth from space from missions such as Apollo 8 and the Voyager satellites have invigorated the environmental movement by showing how the Earth is a precious resource not easily replaced. Through lectures, readings, and in-class assignments, discussions, and questions, these ideas will be explored. Examples: Lectures: Lectures in this class discuss the Copernican Revolution and how the observations of Galileo and Tycho showed that the Earth was not the center of everything and that the sky was changeable. Lectures will also draw attention to important holidays from calendars different than the Western civil calendar, such as the Jewish New Year,

	Passover, Ramadan, Chinese/Lunar New Year, and Easter and discuss how those calendars use different conventions from the Western calendar. Assignment #2 and #3 -- These readings and associated questions from Empires of Time: Calendars and Cultures discuss the construction of calendars by several cultures, from the more informal "natural time" system of the X society to the complex interlocking calendars of the Maya to the establishment of the current Western calendar. Students are asked to distinguish between commonalities across cultures, such as night and day and the year from arbitrary choices, such as the length of the week, the start of the new day and the new year. In-Class Exercise: Students experience the appearance of the sky from Mercury in the planetarium, where the much brighter Sun moves very slowly across the sky because of Mercury's slowed rotation thanks to the gravity of the Sun. Next, they read the opening pages of Kim Stanley Robinson's 2132 about the culture of the "sunwalkers," human colonizers desperate for a glimpse of the Sun that can burn them to death and identify specific behaviors and cultures of the sunwalkers in response to their environment. Assignment #10: Subsequent to the in-class exercise mentioned above, students pick a solar system object or exoplanet with a characteristic different than the Earth, such as a very elliptical orbit. They then write a 2-page essay about a possible cultural behavior that civilizations on that planet could adopt in response to that characteristic. This not only gives the students a chance to reflect on how the environment could be different than the Earth, but also reinforces the beliefs and behaviors than the properties of the Earth have imposed on us of which we are often unaware.
ELO 4.2 Describe how humans perceive and represent the environments with which they interact.	Students will describe how humans have perceived and represented the night sky using constellations, archaeo-astronomical sites such as the Hopewell Ceremonial Earthworks and Stonehenge, and models of the solar systems, such as the perfect circles of Aristotle. Examples: Lectures: Students will be introduced to structures that encode or represent the night sky, such as the Tomb of Seti I. The uses of constellations across cultures will be presented. Ancient to modern models of the solar system will be analyzed, including addressing the question of the reality of the mechanisms proposed, from the crystalline spheres to gravity. In-Class Exercises: Students will discuss the choices made in famous depictions of the sky, including Chinese star maps, Islamic astrolabes and Van Gogh's *The Starry Night* Homework: #1: Students will describe how 3 different cultures described the same part of the sky

	#3: The readings from *Empires of Time* discuss the importance of Venus for the Mayan calendar and culture and the alignment of Mayan cities with the positions of Venus on the horizon.
ELO 4.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.	Students will understand the current debate about the effect of human activity on the sky, including light pollution, large satellite constellations from companies such as Starlink, and the ramifications of increasing large amounts of spacecraft and debris orbiting the Earth. They will analyze questions about putting a value on dark night skies and how to balance dark skies with other needs, such as for communication or safety. Proposals for the regulation of the use of space will be discussed and examined. Students will use examples of conflicts between astronomical and other uses for mountain tops, in particular Mauna Kea, to analyze and critique theories about land use.