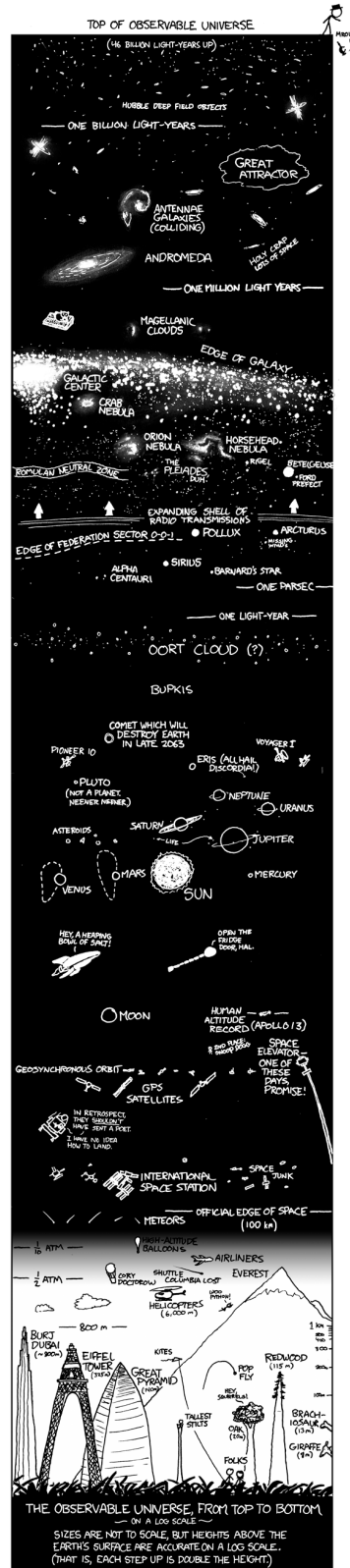




PHYS 561 01W –ASTRONOMY AND ASTROPHYSICS FOR EDUCATORS ONLINE COURSE SYLLABUS: Fall 2023



Source: <https://xkcd.com/482/>, and also see <https://www.explainxkcd.com/wiki/index.php/482: Height>

Instructor: Dr. Mahendra Thapa

Office Location: Online

Cell Phone: 513-417-4087

University Email Address: Mahendra.Thapa@tamuc.edu

In emails, please put "PHYS 561 Online" in the subject header. I will reply to emails within 48 hours (and usually within 24 hours). **Note:** *I will exclusively use your TAMUC university email addresses for email communication.*

Course Time Zone: Central Time USA

Online Office Hours: I will post as an announcement.

COURSE INFORMATION

Materials – Textbooks, Readings, Supplementary Readings

The required book can be ordered from online retailers. (Previous students have noted that the "international" edition is complete).

Textbooks Required

Ryden, B. and Peterson, B.M. (2010), *Foundations of Astrophysics*, Addison-Wesley, ISBN-10: 0321595580, ISBN-13: 978-0321595584

Course Prerequisites

Math: Students are required to know mathematics through Calculus 3 or equivalent, or have taken or be currently taking *Mathematical Methods for Educators Course* (PHYS 530). We'll be making extensive use of algebra, trigonometry, basic differentiation and integration, plus some occasional (simple) ordinary differential equations.

Physics: A course in calculus-based physics (sometimes called University physics) is required. Some knowledge of basic thermodynamics and statistical mechanics will be an advantage, but I will explain concepts from those subjects when we need to use them.

Course Description

Topics in stellar structure and evolution, galactic evolution and dynamics and cosmology will be studied, making use of real data, simulations and projects

based on citizen science initiatives such as the Zooniverse that open up astronomical research participation to the public. Prerequisites: University physics and calculus up to partial differential equations¹.

How far away are the stars and galaxies we see in the night sky, what are they made of, and how do they shine? How did the cosmos and its constituents come into being, and what does their future hold in store? These are the concerns of Astronomy (the measurement of the properties of the universe and its constituents) and Astrophysics (the application of the laws of physics, as best we understand them, to explain those properties); these two terms are often used interchangeably.

Astronomy and Astrophysics captures the public imagination like no other area of science – some of us like to call it the “gateway science” for students. The latest pictures from our most powerful telescopes fill us with awe, but how well do we understand what we are seeing? The latest discoveries and breakthroughs are routinely reported in the popular media, sometimes without a full appreciation of the implications, or limitations, of the discovery. As educators it is important that we are able to accurately address such astronomical topics as they arise, particularly when curious students ask about them. To do that, we need a good knowledge of the current state of astronomical knowledge, and the physics at play in stars, galaxies and the cosmos. We also need to know what the good astronomy resources are to aid learning.

Astrophysics is a unique branch of physics in which the objects of study are not accessible to controlled experimental investigation in the laboratory; it is an *observation*-driven science. We know what stars are made of, despite the fact that they appear only as points of light unfathomable distances away. We know the universe is around 13.7 billion years old, and originated in an intense fireball that we call the Big Bang, despite the fact that we can't travel back in time to check this out. It is important we understand how we come by this knowledge, and some of the techniques used in figuring it out.

The purpose of this class:

1) To give you a working knowledge of stars, galaxies and the universe, and how the laws of physics are applied to them. We will learn about how stars are born, live and die, how they live on after death as white dwarfs, neutron stars and black holes, and how they are organized on a large scale as clusters and galaxies. We will understand how to use the mathematical laws of physics to predict their properties, on the way learning useful techniques that can be applied to many other subjects, and even in everyday

¹ <http://coursecatalog.tamuc.edu/grad/courses/phys/>

situations. We'll also cover some of the latest hot topics in astronomy and astrophysics, such as exoplanets, gravitational wave observations, dark matter and dark energy.

2) To discuss how to present the topics we will cover to a high school audience, design lesson plans and explore the many tools available on the web to aid us. In particular, we will look at a number of citizen science projects, which allow the general public to participate in genuine astronomical research by analyzing real data, and learn about astronomy in the process.

3) To examine the education literature to understand the common misconceptions and difficulties encountered teaching astronomy and astrophysics, and use that literature to inform our own learning.

Student Learning Outcomes

At the end of the course students will:

1. Demonstrate mathematical reasoning skills that are particularly important in astronomy and astrophysics, such as order of magnitude estimating and Fermi problems.
2. Be able to apply the laws of physics to describe the structure and evolution of stars, galaxies and the universe.
3. Demonstrate an accurate knowledge of stellar structure and evolution, galaxy structure and evolution, and cosmology, and the methods and reasoning that allow us to deduce this knowledge
4. Summarize the ongoing arguments and progress at the forefront of astrophysics on topics such as dark matter/energy, the big bang, exoplanets, and gravitational wave astronomy in a manner understandable to the general public and high school students. Be able to accurately assess where the balance of evidence lies regarding these topics, and critically analyze articles and portrayals of astronomy and astrophysics in the popular media.
5. Create lesson plans which accurately and engagingly introduce astronomy and astrophysics principles to high school students, making use of internet resources including citizen science projects relating to astronomy and astrophysics.
6. Gain knowledge of the scope of astronomy education literature and understand what it has to say on astronomy misconceptions and conceptual difficulties.

COURSE REQUIREMENTS

Instructional Methods / Activities / Assessments

The details of the course structure are given below. Any changes will be communicated via email and announcements on MyLeo Online. Your TAMUC email account will be used at all times, and it will be your responsibility to check it regularly (at least once every 24 hours).

Introductory tasks and due dates

The semester starts at **12.01 a.m.** on August 28th, which is when the introductory material and unit 1 will become available.

To gain access to Unit 1 and the rest of the course, you must complete the following activities which you can find in the introductory module:

- (1)** Read the **syllabus**
- (2)** Take the **syllabus quiz** to make sure you understand the mechanics of the course. This can be taken *any number of times*. The **syllabus quiz** will not be graded, but it must be completed *with 100% correct answers* before unit 1's material becomes available.
- (3)** **Introduce** yourself to the class on the "**Class Introductions**" discussion thread.

NOTE: You must complete the syllabus quiz with 100% correct answers to access the first, and subsequent, units.

Regular unit tasks, material and due dates

The course material is organized into 5 units of three weeks each. Each unit covers a major topic in Astrophysics and leads up to either a major frontier of research or a fundamental tool or concept that Astrophysicists use all the time. Each week you will be required to complete discussion posts and quizzes, and homework will be assigned each week and collected in at the end of each unit.

Unit 1, is available from the first day of the semester, **Monday, Aug 28th**, and the other units become available on the dates shown on the table at the end of the syllabus. All three sections of material associated with the unit become available when the unit becomes available. Although you don't need to follow a weekly schedule for the homeworks, which are due at the end of the unit, you

should stick to the weekly schedule for reading and watching the lectures as much as possible, and you are required to make discussion posts and complete the quizzes *each week*. Except for the first week and last week, discussion threads and quizzes become available on a **Friday at 12.01 a.m.** and ends on the **Sunday 9 days later at 11.59 p.m. (midnight)**. For example, the week 2 discussion threads and quizzes open on **Friday, Sept 1st at 12:01am** and discussion posts and quiz are due **Sunday, Sept 10th at 11:59pm**. All of the unit's materials and assignments become available only when the unit starts.

During each week, the following tasks will be assigned, to be completed either by the end of the week (in the case of discussions and quizzes) or the unit (note: reading and viewing material are necessary to take part in the discussion and complete the quizzes accurately).

- (1) Complete the **reading assignments**. These will come from the course textbook or online articles and material.
- (2) Watch the unit's **1-7 Mini-lectures** which will cover one or two key concepts at a time, to reinforce reading material, or give examples of problem solving. Sometimes I will post mini-lectures covering concepts according to student demand.
- (3) Complete the **quizzes** designed to assess students' comprehension of the reading assignments, mini-lectures and basic knowledge of key principles. Quizzes must be completed by **11.59 p.m. the Sunday** that concludes the corresponding week.
- (4) Participate in the **discussion threads**. Each week you must make at least 3 substantial posts (i.e., **starting a thread, not just replying to an existing thread**) in each of the current unit's topics, and 2 responses to posts in the *previous* unit's topics. A unit's discussion thread opens at **12.01 a.m. Fridays** and remains open throughout the semester.
- (5) Complete the **homework**. All three sections' homeworks will become available with the unit. Although they are intended to be completed every few days, they are collected every three weeks at the end of each unit to allow some amount of self-pacing. However, you should attempt to work through homeworks at a steady pace; attempting to do all of them at the end of the third week will result in medically inadvisable stress and under-par results.

A complete list of due dates for discussion posts, quizzes and homeworks are given at the end of this syllabus.

Learning Activities and Assessments

The following describes the assignments you must complete which will contribute to your progress through the course and to your final grade, together with how they will be assessed.

- **Quizzes** are designed to assess students' comprehension of the reading assignments, mini-lectures and basic knowledge of key principles, often in response to the mini-lectures and reading assignments.

Quizzes are designed to provide you with initial assessment of your learning and *will not be graded based on whether you got the answer correct, but that you have attempted an answer thoughtfully*. A small amount of extra-credit will be available for correct responses, however.

You will only be able to take quizzes once. Once you begin taking the quiz, you will have a time limit of 75 minutes to complete it. Once completed, you cannot return to it and revise your answers. You will see your score, however, and what answers you got wrong.

Quizzes address: Learning Outcomes 1-4

- **Ongoing Discussions** will be conducted during each section on the concepts introduced in the reading material and lectures. A number of threads will be opened, one per topic. Sometimes I will ask a question or pose a problem to get you started.

Learning and understanding is significantly enhanced by active engagement in the class through continual discussion of topics. All students are required to participate in the discussions with a number of substantive posts. **Students are required to make 3 substantive posts, in three separate threads, giving your thoughts about the reading or answering the opening questions. In addition, students are required to make two posts in the *previous* section's threads, replying to posts of other students or of myself. That makes a total of 5 posts per unit that will be graded.**

The rubric for grading the online discussions is found on pp.20-21 of the course syllabus.

Of course, continued discussion beyond the minimum posts required is strongly encouraged. I will pitch into the discussion at various times during the unit, answering queries and asking new questions to make sure we discuss all the unit's material adequately.

The discussion forums are where you should ask for *help as soon as you need it*. Be specific about the questions you ask. I will prepare supplementary lectures going over examples and explanations in response to certain questions that come up, but to do that you need ask questions as soon as they come up.

When appropriate, at least one thread will be devoted to discussing how one might teach the unit's concepts at the high school or undergraduate level, and for the sharing of your own experiences and resources for the benefit of the teaching community.

I hope to make the discussion threads a fun and lively forum throughout the semester!

Discussions address: Learning Outcomes 1-6

A **Homework** will be assigned for each section. These will come in two flavors; (i) problems and reading reflections covering the **essential concepts** and content of astronomy education readings, and **applications** which build throughout the unit to result in a mini-project related to the overarching research frontier or concept/tool for the unit. Full instructions will be provided each week, together with the method of assessment.

Homework can be delivered to D2L at any time, up to the due date.

Virtual labs as part of some homeworks will often be conducted using the open educational resource PhET simulations.

Homework that involves problem solving, pictures, or other material that is difficult to submit as a Word format or similar, may be submitted as hand written work scanned in or photographed. If you use a camera phone to take pictures of your work, please use an app that scans to PDF. A useful app is CamScanner (<https://www.camscanner.com>) or TinyScanner, which compiles multiple pictures into one document for ease of uploading. There is a free version that I encourage you to check out. Make sure that your work is legible in scanned form. Other apps are also fine if you already have one.

Homeworks address: Learning Outcomes 1-6

GRADING

Full completion of quizzes – roughly (2/3)% each section (15 sections total)	10%
Performance on Quizzes – roughly 1% each section	15%
Discussion – roughly 2% each section	30%
Homework: Essential concepts (~2%/section)	25%
Homework: Applications - ~(4/3)%/section)	20%
Extra Credit (TBD)	Up to 5%

Current scores will be available for students to see in the Gradebook.

Grading Scale:

90-100%	A
80-89%	B
70-79%	C
60-69%	D
<59%	F

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). The technical requirements are:

LMS Requirements:

<https://community.brightspace.com/s/article/Brightspace-Platform-Requirements>

LMS Browser Support:

https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for

IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu.

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:

<https://community.brightspace.com/support/s/contactsupport>

COMMUNICATION AND SUPPORT

The following is the list of communication methods used in this class and their purposes. These include student-instructor, instructor-student and student-student communication.

You will be expected to check your university email account and log onto MyLeo Online at least once every 24 hours Monday-Friday in order to keep abreast of the latest class announcements.

- **Email** will be used by me to communicate to the class as a whole general information about upcoming assignments, due dates, and any changes in the schedule or syllabus that might occur.

I will also email students individually with occasional feedback from assignments and on the class as a whole.

Students can use email to ask me any questions about (i) course logistics (upcoming assignments, due dates...) (ii) as any questions about the way their specific assignments were graded and feedback they have been given (iii) constructive comments on how the course is going and any problems and/or concerns with the course structure (including things that you think are particularly good!).

In emails, please put "PHYS561 Online" in the subject header. I will reply to emails within 24 hours (48 at weekends and holidays)

I will always send emails to your official University Email address as given through MyLeo. It will be your responsibility to check your

university email regularly.

- **Announcements** on MyLeo Online will be used to communicate to the class as a whole general information about upcoming assignments, due dates, and any changes in the schedule or syllabus that might occur. New announcements will appear to you the next time you log in to MyLeo Online.
- **Discussion threads** for each unit should be the main way in which you ask and debate the answer to questions you have about the course material itself. Here you can brainstorm problem solving techniques and analyses of reading material. These questions should be continually addressed by your fellow students, and by myself, although in the spirit of discussion concrete answers will only be given after an honest and sustained attempt to figure out the answers yourselves.
- **We will use Zoom for live office hours –.**

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures

Academic Honesty

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including (but not limited to) receiving a failing grade on the assignment, the possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. In **ALL** instances, incidents of academic dishonesty will be reported to the Department Head. Please be aware academic dishonesty includes (but is not limited to) cheating, plagiarism, and collusion.

Cheating is defined as:

- Copying another's test or assignment.
- Communication with another during an exam or assignment (i.e. written, oral or otherwise).
- Giving or seeking aid from another when not permitted by the instructor.
- Possessing or using unauthorized materials during the test.
- Buying, using, stealing, transporting, or soliciting a test, draft of a

test, or answer key.

Plagiarism is defined as:

- Using someone else's work in your assignment without appropriate acknowledgement.
- Making slight variations in the language and then failing to give credit to the source.

Collusion is defined as:

- Collaborating with another, without authorization, when preparing an assignment.

If you have any questions regarding academic dishonesty, ask. Otherwise, I will assume that you have full knowledge of the academic dishonesty policy and agree to the conditions as set forth in this syllabus. **Homework and discussion posts will be randomly tested for plagiarism.**

Attendance Policy

In an online class, attendance means active participation; students are expected to spend at least 2 hours/week on the discussion threads and at least 10 hours/week is required to complete all the assignments, including reading. At least five substantive discussion posts are required by each student each unit to gain full points on the discussion part of the grade. If you are unable to log on for an extended period of time (greater than a week) then contact me *in advance* to discuss how to proceed. We recognize that many of you already have a busy work schedule, and that occasionally you might get behind in a unit. Spending even 15-30 minutes a day on class material and the discussion threads will help greatly, ***and if you find yourself struggling at any time, please do not hesitate emailing me; I can be flexible to accommodate your busy schedule.***

Assignment policy

Students will be responsible for knowing when due dates for homeworks, quizzes and projects are by reading the syllabus, looking at the schedules under "Course Home" and in this syllabus, and reading the relevant sections when posted on eCollege. If the schedule changes, you will receive an email and an announcement on eCollege about it.

Late work

Late homeworks will be penalized by 10% by each day they are late (i.e. a Homework submitted more than 10 days late gets no credit). Late projects (except the last one, which is due by the last day of classes) will be penalized by 10% by each day they are late. Quizzes and discussion posts will not be accepted past the due date.

Netiquette: Communication Courtesy Code

Students are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. The same rules apply online as they do in person. Be respectful of other students. Foul discourse will not be tolerated. Please take a moment and read the following links concerning "netiquette". <http://www.albion.com/netiquette/>
<http://www2.nau.edu/d-elearn/support/tutorials/discrubrics/netiquette.php>

UNIVERSITY SPECIFIC PROCEDURES

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the [Student Guidebook](#).

<http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx>

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: [Netiquette](#)
<http://www.albion.com/netiquette/corerules.html>

TAMUC Attendance

For more information about the attendance policy please visit the [Attendance](#) webpage and [Procedure 13.99.99.R0.01](#).
<http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx>

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf>

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

[Undergraduate Academic Dishonesty 13.99.99.R0.03](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf>

[Graduate Student Academic Dishonesty 13.99.99.R0.10](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf>

ADA Statement

Students with Disabilities

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

Texas A&M University-Commerce

Gee Library- Room 162

Phone (903) 886-5150 or (903) 886-5835

Fax (903) 468-8148

Email: studentdisabilityservices@tamuc.edu

Website: [Office of Student Disability Resources and Services](#)

<http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/>

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a

Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the [Carrying Concealed Handguns On Campus](#) document and/or consult your event organizer.

Web url:

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf>

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

ONLINE DISCUSSION RUBRIC

Your discussion posts will be graded using the following rubric. Each unit's discussion posts contribute up to 2% to your final grade.

Note: One post counts as 100 words or more on topic. Posts with less words or posts not addressing the unit's class topic will not be considered for grading. Of course, the discussion should be allowed to flow naturally, and shorter posts will naturally occur, including one word posts of the type "I agree!" and "Yes!" or "No!". This is fine, and indeed necessary – it is just that the grading will be based upon posts of 100 words or more.

A reminder that netiquette should be observed at all times: please make sure you visit and understand the following resources:

<http://www.albion.com/netiquette/>

<http://www2.nau.edu/d-elearn/support/tutorials/discrubrics/netiquette.php>

Criteria	Unacceptable(0)	Poor (1)	Good (2)	Excellent (3)
Number of posts	No posts during the unit.	1-2 posts during the unit.	3-4 posts during the unit.	5 or more posts during the unit.
Spelling and Grammar	Posts are not in complete sentences, or more than half of the sentences have spelling or grammatical errors.	Between a quarter and half of sentences have spelling or grammatical errors.	Less than a quarter of sentences have spelling or grammatical errors.	No spelling or grammatical errors.
Knowledge	Posts demonstrate no evidence of knowledge of the unit's reading.	Posts demonstrate evidence of only a cursory reading of the unit's material, and little attempt to critically analyze it.	Posts demonstrate reasonable knowledge of the unit's reading, and an attempt to critically analyze it.	Posts demonstrate evidence of comprehensive knowledge of the unit's reading, and significant attempts to critically analyze it.

Appropriateness and awareness of other student contributions	Posts rude/disrespectful. No attempt to build upon other students' posts or support other people's arguments.	Minimal acknowledgment of other students' posts. Little attempt to build upon arguments.	Reasonable attempts to build upon other students' posts and contribute to their arguments.	Excellent awareness of other students' posts and substantial efforts to contribute to their arguments.
References and support	Arguments are unsupported, come across as unsubstantiated opinion.	Minimal support for students' arguments. Student's thinking unclear, hard to discern how student arrived at their conclusions.	Reasonable attempt to justify arguments made, with some references to the unit's reading and external sources where appropriate.	Arguments are fully backed up, with clear explanations of how the student arrived at their conclusions, with full references to the unit's reading or to external sources where appropriate.

Credit: The following online rubrics have been used to inform the development of the rubric above:

<http://www.udel.edu/janet/MARC2006/rubric.html>

<http://www2.nau.edu/d-elearn/support/tutorials/discrubrics/discrubric.php>

https://topr.online.ucf.edu/images/f/f0/IDL6543_Discussion_Rubric.pdf

READING REFLECTION HOMEWORK RUBRIC

Each reading assignment will be accompanied by one or more writing prompts. Students should follow the directions in the prompts. Homework will be graded according to the following rubric. Note that the maximum possible score is 16 points. Scores will be converted to percentages, so that a raw score of 16 is 100%.

Points	4	3	2	1
Clarity of main points	Main points are clear and easy to comprehend.	The main points are mostly clear, but slightly difficult to comprehend.	Main points are difficult to identify, or writing is difficult to comprehend.	Writing is incomprehensible.
Detail	Writing includes many specific details that are related to the main points.	Writing includes some specific details that are related to main points.	Writing includes very few specific details, or there are many details that are unrelated to the main points.	Writing includes no specific details.
Argument	The writer connects their main points with the details they have provided and makes a coherent argument.	The writer connects some of their main points to details provided, but the argument is may not be logically clear.	The writer's arguments or justifications are difficult to follow.	The writer includes no arguments or justifications.
Relevancy	Writing is completely related to the prompt.	Writing is mostly related to the prompt but is occasionally off topic.	Writing is occasionally related to the prompt but is mostly off topic.	Writing is completely unrelated to the prompt.

COURSE OUTLINE / CALENDAR

This schedule is tentative. Weeks open at 12:01am, Monday on the date shown

Unit	Sect'n	Date week opens	Topic	Chapter/Sections
1. The Basics: Scales, Empirical Properties and Physics Interpretation Capstone modern research area: Exoplanets	1	Aug 28	Understanding how far and how big things are: the scales of the universe The messengers of the universe: what transports information from the stars to us. EM radiation, neutrinos and gravitational waves The instruments that detect the messengers	6
	2	Sep 1	What we see: the basics. There are bright things in space! The magnitude system, luminosity Things move! Orbits (Kepler's laws), Parallax (measuring distance) Why bother with physics in astronomy? Measuring mass	2.5, 3.1.3, 13.1,13.2, 13.5
	3	Sept 8	Finding and understanding exoplanets	12.3, 12.4

2. Measuring the stars: what information does starlight hold?	4	Sep 15	Color index, blackbody radiation and temperature of stars, Emission/absorption spectra	5.7, 13.3, 5.1, 5.2, 5.3
Capstone concept: the HR diagram; analyzing astronomical data	5	Sep 22	Spectral classes, luminosity classes, spectroscopic parallax, radiative processes, Interstellar medium	14.2, 14.3, 10.2.1, 16.1, 16.2,
	6	Sept 29	Communities of stars: Galaxies, clusters of stars and The HR diagram,	19, 14.4
3. Dissecting a star: what physics predicts about the anatomy of stars. Testing those predictions. Capstone concept: simulating star lives, interpreting computational data ("computational experiments") and comparing it to empirical data	7	Oct 6	Hydrostatic equilibrium, mass conservation, The Virial theorem. Estimates and scaling relations	14.1, 15.1 (up to beg. of 15.1.1)
	8	Oct 13	Energy production and transport (opacity, radiation, convection), the equations of stellar structure, more estimates and scaling relations	15
	9	Oct 20	Testing stellar models: measuring mass, radius, the main sequence, the distances to clusters, ages of clusters (MS turn-off). Simulating star lives.	13, 5.3, 14.1
4. The life (and death) stories of stars. Capstone modern	10	Oct 27	Stellar birth, evolution of Sun-like stars, white dwarfs massive star evolution	17.1, 17.2, 17.3, 18.1
	11	Nov 3	Supernovae,	18.2-18.4

research area: Gravitational wave and multi- messenger astronomy			Neutron stars and Black holes	
	12	Nov 10	Relativity, Gravitational waves and their detection, Multi-messenger astronomy	23.3
5. The study of the entire universe as a single physical system: Cosmology.	13	Nov 17	Communities of galaxies: Galaxy clusters, radiation from everywhere and mapping the structure of the universe	22
Capstone research area: The dark sector – energy and matter	14	Nov 24	Applying physics to understand the universe as we see it: The Friedmann equation and the Big Bang Model of the universe	23, 24.1
	15	Dec 1	The content of the universe: we don't know 95% of everything, but we do know that we don't know it!	24.2-24.4

COURSE DUE DATES: DISCUSSION POSTS

In each unit you must post at least **one** post in each of **three different** discussion threads, giving your initial thoughts on the subject of the thread or any conceptual or mathematical difficulties you are having with the thread subject. You must also post at least **two** follow up posts in your choice of the **previous unit's** threads, responding to another person's comments, or one of my comments. That makes a total of **five** posts per unit that will be graded.

Discussion threads for a particular unit open at **12.01 a.m.** each **Friday** with the rest of the unit's material. To receive credit for your posts, they must be made within the time-frame outlined below. The threads remain open until the end of the semester. (I believe all of these dates are correct, but if you find an error, please let me know).

Section	DISCUSSION THREADS OPEN	3 POSTS IN 3 DIFFERENT THREADS DUE	2 FOLLOW-UP POSTS DUE
1	28-Aug	3-Sep	10-Sep
2	1-Sep	10-Sep	17-Sep
3	8-Sep	17-Sep	24-Sep
4	15-Sep	24-Sep	1-Oct
5	22-Sep	1-Oct	8-Oct
6	29-Sept	8-Oct	15-Oct
7	6-Oct	15-Oct	22-Oct
8	13-Oct	22-Oct	29-Oct
9	20-Oct	29-Oct	5-Nov
10	27-Oct	5-Nov	12-Nov
11	3-Nov	12-Nov	19-Nov
12	10-Nov	19-Nov	26-Nov
13	17-Nov	26-Nov	3-Dec
14	24-Nov	3-Dec	10-Dec
15	1-Dec	10-Dec	14-Dec

COURSE DUE DATES: QUIZZES

The **syllabus quiz** becomes available on **Monday August 28** at **12.00 a.m.** For the syllabus quiz only, you may take the quiz as many times as you like. You will only gain access to unit one once you have made 100% on the syllabus quiz.

Quizzes on each unit's reading material become available at **12.00 a.m.** each **Friday** along with the rest of the week's material, and close at **11.59 p.m. (midnight)** the following **Sunday**, (usually) **9 days later**.

NOTE: Apart from the syllabus quiz, quizzes can only be attempted once. Once you begin taking the quiz, you will have a time limit of 75 minutes to complete it. Once completed, you cannot return to it and revise your answers.

SECTION	QUIZ AVAILABLE	QUIZ DUE
1	Aug 28	Sept 3
2	Sept 1	Sept 10
3	No Quiz	No Quiz
4	Sept 15	Sept 24
5	Sept 22	Oct 1
6	No Quiz	No Quiz
7	Oct 6	Oct 15
8	Oct 13	Oct 22
9	Oct 20	Oct 29
10	Oct 27	Nov 5
11	Nov 3	Nov 12
12	No Quiz	No Quiz
13	No Quiz	No Quiz
14	Nov 24	Dec 3
15	No Quiz	No Quiz

COURSE DUE DATES: HOMEWORKS

All Homework becomes available when the unit opens. There are 3 homeworks per unit, one for each section. All three are due at **11:59pm** on the due dates shown in the calendar below. Any time a homework is submitted (if before the due date), it will be considered ready for grading. If you submit before the deadline, and find a mistake you want to correct, just submit a new corrected version before the deadline. I will only grade the last-submitted item.

UNIT	HW AVAILABLE	HW DUE
1 (Sections 1-3)	Aug 28	Sept 24
2 (Sections 4-6)	Sept 15	Oct 15
3 (Sections 7-9)	Oct 6	Nov 5
4 (Sections 10-12)	Oct 27	Nov 26
5 (Sections 13-15)	Nov 17	Dec 14