

# INTRODUCTION TO ASTRONOMY

**Meeting Times:** MWF 1pm - 1:50pm | **Where:** WEL 3.502 | **Unique Number:** 47915

## How can I contact my professor or TAs?

### Professor:

Dr. Keely Finkelstein  
Dept. of Astronomy  
Office:  
My pronouns: she/her/hers

Email:  
[keelyf@astro.as.utexas.edu](mailto:keelyf@astro.as.utexas.edu)

### Instructor Weekly Drop-In

#### Hours:

See Canvas Calendar for links

### TA:

## What is this course about?

This course is an introductory survey course into general Astronomy. Topics will cover everything from stars, planets, and galaxies. We will focus on conceptual understanding, rather than memorization of facts, although you do need to remember some fundamental ones. You will learn how science works, and develop critical thinking skills while you gain insight into how the Universe works. You will use physical, quantitative, and graphical models to explain and understand natural phenomena in the cosmos. These skills should help you understand news about incredible scientific discoveries, whether they are true, or just a hoax.

Astronomy is an observational science. This class will discuss how observations are made, discussion of “natural phenomena” and some of the needed ideas from physics to help us understand these observations. We will also introduce many of the areas of physics necessary to appreciate the origin and evolution of stars, planets, and galaxies.

This course carries the *Quantitative Reasoning flag*. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

## What are the Required Materials?

**Textbooks:** We will use two textbooks for AST 301: "Lecture Tutorials for Introductory Astronomy", Prather et al. 4th Edition (this can be purchased at the Co-Op or online).

And good news: the second textbook, "Astronomy" from OpenStax, for this course is available for free online, in web view and PDF format!

[www.openstax.org/details/astronomy](http://www.openstax.org/details/astronomy)

It will also be available in PDF format on Canvas. You can also purchase a print version, if you prefer, via OpenStax on Amazon.com.

You can use whichever formats you want. **Web view** is recommended -- the responsive design works seamlessly on any device. If you buy on Amazon, make sure you use the link on your book page on openstax.org so you get the official OpenStax print version.

## Other Required / Recommended materials:

**In-class response system** - we will be using a system through Canvas, called **InstaPoll**. Be prepared to answer polling questions in real time during Class Meet Ups - to respond to instructor questions and get immediate feedback.

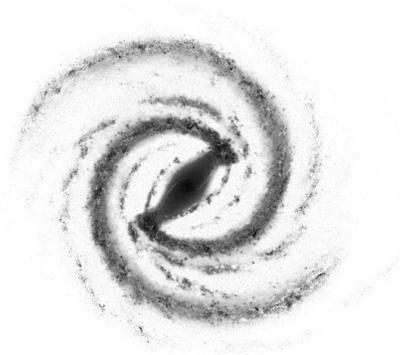


Image credit: <http://www.enderra.com>

## Course Learning Objectives:

Core course themes and learning objectives are centered around the following, and *by the end of the semester students will be able to:*

### **Theme: Cosmic perspective, specifically:**

- Demonstrate an understanding of the nature, scope, and evolution of the Universe, and where the Earth and Solar System fit in.
- Demonstrate an understanding of related subjects / content (e.g., gravity, light, spectra) and use "tools" from related subjects such as mathematics and physics.
- Use critical thinking and quantitative reasoning skills, and gain an understanding of the importance of them in the broader context of the scientific process and scientific theory.

### **Theme: Gravity and Motions of the Sky, specifically:**

- Apply Kepler's laws in our Solar System and other planetary systems.
- Discuss objects in the night sky and explain how its appearance changes with time and position on Earth.
- Explain the origin of seasons on Earth.
- Examine phases of the moon using models.
- Develop a model of the Sun's annual path through the observer's sky.
- Predict a phase of the moon, or times related to a specific moon phase based on the model.
- Apply Newton's laws of motion and universal law of gravity to common examples, and explain reasoning.
- Be able to reason about magnitude and direction of forces acting on bodies due to the force of gravity.

### **Theme: An understanding of Stars and Stellar Evolution, specifically:**

- Use a Hertzsprung-Russell diagram to describe a given stellar population.

## Course Website:

Canvas page for this course:

## Where can I find... ?

### Canvas will have the following:

1. Lecture slides & Lecture Videos
2. Weekly reading assignments / modules
3. Weekly quizzes
4. List of Learning Objectives
5. HW assignments
6. Gradebook
7. Discussion Board for weekly Group Discussion Posts
8. Important Announcements
9. Access to the ebook (main course textbook)



*Canvas will always be our main form of communication, so please make sure to check it regularly and stay up to date on assignments and communications.*

- Explain the origin of elements heavier than helium.
- Describe the death of stars for a range of masses.
- Analyze spectra of different objects and compare their temperatures.
- Combine knowledge of Wien's Law and the Stefan-Boltzmann Law to analyze spectra and estimate the relative sizes of two stars.

### ***Theme: Cosmology: From the Big Bang to the Present Day, specifically:***

- Discuss evidence for the Big Bang.
- Describe dark matter and dark energy and articulate the differences between the two.
- Identify different types of galaxies, and discuss how galaxies form and evolve.

### ***Theme: Possibilities and implications of life in the Universe, specifically:***

- List necessary ingredients for life.
- Determine if a planet is in the habitable zone.

## Content / Lecture Delivery:

- The pre-class content and materials will be shared with you as pre-recorded mini videos and readings. You will be assigned short videos to watch which will be posted in the module sections, these will often be accompanied by additional reading materials and/or other video resources shared in the weekly modules.
- After watching the video there will be a short practice quiz with assigned problems.
- Note: ***Class recordings are reserved only for the use of members of this class (students, TAs, and the instructor) and only for educational purposes. Recordings should not be shared outside the class in any form.***
- In addition, there will be required Module Discussion Groups. You can complete these on your own time schedule, but you will need to join a Discussion Group and post answers to the discussion questions in each Module, along with responding to one other group member's post. More details about this are on Canvas and listed below in the Participation section.

## What happens during regular class time (MWF 1-2pm)? - *Class Meet-ups:*

- We will meet in-person during our regularly scheduled class times. MWF 1-2 pm.
- Every Class Meet-Up coupled with the pre-recorded asynchronous mini lectures will have specific Learning Objectives associated with it. We will focus on these Learning Objectives during Class Meet-Ups, and will use this time to work in small groups on the assigned Lecture Tutorials and answer practice problems with Instapoll (part of your Course Participation grade).
- You will have the opportunity to ask your peers, your TAs, and me questions about the material both at regular class time, MWF 1-2pm, and at other times (*Drop-In Hours*). See Canvas for scheduled meetings and available times.
- A majority of Content from Lectures will be pre-recorded and posted on Canvas in the modules section. I will also post electronic copies of the slides in the Lecture Slides Page on Canvas. You'll be able to review the slides / re-watch the videos and lectures on Canvas at anytime.
- In addition, Lectures will be captured using the [Lecture Online System](#). You'll be able to review / re-watch the slides and lectures afterwards on Canvas. Links for the recordings will appear in the Lectures Online tab on the Canvas page for this class..

## *General Class Information and Expectations:*

### *Class Format:*

AST 301 will be taught in-person in Fall of 2022. Attendance in each class is expected, however if you occasionally need to miss class you can catch up through the recorded Lectures Online, and there are a number of built in drops for class participation.

### *Expectations for students in the classroom environment:*

**Environment:** I am committed to providing you with a friendly, productive, and effective learning. There are things that you can do to help with this:

- **Participate:** Active, engaged participation from students is extremely important in both environments! You are expected to participate in group discussions, work through problems yourself and in groups, and avoid distractions during class. This helps make the class learning environment more productive and enjoyable for everyone!
- **Expectations regarding mutual respect:** Astronomy belongs to all people, independent of race, religion, gender, gender identity, gender expression, or sexual orientation. Incidents of discrimination, assault, harassment, threats, intimidation, profiling, or coercion based on membership or perceived membership will not be tolerated. Show each other respect no matter perceived knowledge or performance in this class, or any other.
- **Questions During Class:** I'm always happy to take questions during lecture; please don't hesitate to volunteer, ask a question when something is unclear \*you are likely not alone\*.

## How is my performance in this class assessed?

There will be 4 unit exams. The exams will consist of short answer problems and multiple choice questions, and will be given in class (see schedule). We will also have weekly reading quiz checks (through Canvas), Lecture Tutorials, and Graded Discussion Posts + Instapoll Voting questions to provide feedback on your progress between exams.

There are also three course projects that will be due throughout the semester, and each are somewhat different in format: a Moon Journal, an Observing Project, and a Citizen Science Project.

An optional self-directed Astronomy Project can also be completed, and if so it can replace your lowest Exam grade.

Your final course grade will be determined as follows:

**40% - 4 unit exams** None of the exams will be cumulative, e.g. no Final Exam. You will also have the option to replace one of your counted four exams with an Astronomy Project - see details below.

**20% - Weekly Canvas Module Checks For Understanding** (drop 2 of -15 - these will be short mini quizzes conducted through Canvas each week, as a check for your understanding of the presented Module Lecture materials.)

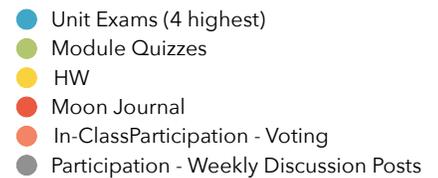
### What is the grading scale?

- 93 - 100 A
- 90 - 92.9 A-
- 87 - 89.9 B+
- 83 - 86.9 B
- 80 - 82.9 B-
- 77 - 79.9 C+
- 73 - 76.9 C
- 70 - 72.9 C-
- 67 - 69.9 D+
- 63 - 66.9 D
- 60 - 62.9 D-
- < 59.9 F

**15% - Participation** - participation will have two components: In-class Instapoll during regular class meet-ups 7%, and Weekly Discussion Posts - 8%. Lowest three “days” or “weeks” in each category will be dropped.

**25% - Class Projects, each project is weighted the same amount, and all are required. See details for each project on Canvas.**

- 1.) Citizen Science Project - due Oct. 5th
- 2.) Observing Project - due Nov. 18th
- 3.) Moon Journal - Dec. 2nd



## Course Policies: What are other policies on exams, assignments, and other course structure?

- **Unit Exams:** Conducted in-class roughly every 3-4 weeks, will cover the material presented in class, and in weekly modules over that time period. Exams will be 50-minute in-class exams. The class period before each exam there will be an in-class review activity.

- **Weekly Module Checks for Understanding:** You are allowed to miss **three** Canvas module "quizzes" without penalty. Late assignments will not be accepted. Your lowest three module quiz scores will automatically be dropped. These weekly Quizzes will be part of the weekly assigned modules on Canvas, and will help you assess that you understand the information covered in the module.
- **Class Meet-UP times:** Most Lecture Content will be delivered ahead of these meetings as pre-recorded videos that you will need to watch on your own. We will then use the class meeting times, MWF 1-2 pm to practice problems, using the Lecture Tutorial work book. We will answer questions from students and/or work in small groups.
- **Class Participation:** There are two components for your course participation grade:
  - We will use **Canvas Discussion Groups** for Participation Credit, due once per week. You will be tasked with joining a weekly Discussion Group, posting to the Group with responses to the assigned discussion questions, and responding to at least one other Group Member's post. More details and step-by-step instructions are given in Canvas. You will receive credit for any answer as long as it follows the required minimum steps. You will be allowed to miss up to three weekly Discussion posts without penalty.
  - We will also use the **Canvas Instapoll in-class voting tool** for participation Class Meet-Ups. You must be in person to access and receive participation credit through Instapoll for these questions, but you will be allowed to miss up to four class participation sets without penalty. We will randomly spot check attendance if you are found to have answered Instapoll questions while not being in class you will not receive credit for those questions. This is also considered a form of academic dishonesty and may be reported to the Dean of Students.
- **Course Projects / Assignments:** There are three required course projects that will be assigned throughout the semester. You can get started on them at any point, but they will be somewhat spaced out and have different deadlines. Due dates and more details for each project can be found on Canvas.
  - 1.) **Citizen Science Project - Assignment details:** You will have the opportunity to engage with real astronomical data through the [zooniverse.org](http://zooniverse.org) platform. You will choose your own astronomy / space-themed project from a selection of ongoing science project for which to contribute to. You will document your classifications / tasks, and reflect on the process.
  - 2.) **Observing Project - Assignment details:** To do this, you will get to visit the telescope on the roof of Painter Hall during one of the Friday and Saturday night public viewing events, or the roof of PMA during one of the Wednesday night events. Information on these events can be found here: <http://outreach.as.utexas.edu/public/viewing.html> You will then hand in a double spaced, two page summary of what you observed, including details of time of observation, and a researched report of your object. You will make a sketch of the object and include that in your report. You must also include proof of attendance, which can be obtained by the telescope operator. Full details to include in this report are listed in the Canvas Assignment Details for this project. *I suggest that you start early, as these events are not held during cloudy / bad weather nights!*

- 3.) ***Moon Journal - Assignment details:*** Go outside find and sketch the Moon for at least ten (10) clear nights over the space of one month. Draw the phase as accurately as you can and include any nearby stars or planets. Do not forget to label the phase (waxing/ waning, new/quarter/full) for each drawing. Make sure you give the time of the observation, as well as the location of the moon in the coordinate system of your choice (i.e., high in the southern sky, low in the SW, etc.). Create a booklet of your drawings to turn in to complete your assignment.
- **Optional Astronomy Project - There a number of different ways to complete this optional project assignment if you choose to do so:** The optional project is very open-ended, but should relate astronomy to something you are excited about. **This is a chance for you to be creative, and spend time researching and thinking about astronomy from a perspective that interests you.** We want you to learn and enjoy the experience, mindful also that the optional project counts as much as one unit exam, so the work you put into it will be reflected in the grade you get out of it.
  - You will pick a specific astronomical object or topic of your choice, and find a creative way to present about it. This could be making an electronic poster, an art project, a video or podcast, a narrated ppt; or something else even more exciting! With your creative representation or presentation, you will be asked to convey some specific information about your object / astronomy topic (described in more detail on Canvas) and connect it to a course learning objective.

*If you choose to complete this Optional Project it can replace your lowest exam score or a missing exam. **More details about this optional project can be found on the Canvas assignment.***

## Where can I find University and Course Resources?



- **Student Support: COVID-19 Updates and Information:** This course may have changes, we all will need to continue to be flexible with the learning environment depending on changing situations. But I will do my best to build in flexibility and options for you to be successful in this course. To help yourself, please explore the resources that continue to be available at: <https://protect.utexas.edu> & <https://healthyhorns.utexas.edu/coronavirus.html>
- If you are experiencing any COVID-19 symptoms or have had a recent exposure, follow the guidance on [UT's Exposure Action Chart](#).
- Community and Self-Testing remains an important part of the university's efforts to protect our community. [Free rapid self-test kits](#) are available at many locations on campus.
- **Academic accommodations (SSD):** This class respects and welcomes students of all backgrounds, identities, and abilities. If there are circumstances that make our learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can

only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities at 471-6259 (voice) or 512-410-6644 (Video Phone) as soon as possible to request an official letter outlining authorized accommodations. For more information, visit: <https://diversity.utexas.edu/disability/current-students/> I am happy to meet in person or virtually over Zoom to discuss more.

- **Counseling and Mental Health Center:** Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. <http://www.cmhc.utexas.edu/individualcounseling.html>
- **The Sanger Learning Center:** Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas (including Astronomy). For more information, please visit <http://www.utexas.edu/ugs/slc> or call 512-471-3614 (JES A332).

## Frequently Asked Questions:

### Do you record the in-class lectures?

Yes! Although there is not much in-class lecturing, it may still be useful to review the video of our think-pair-share discussions, or the debrief after the lecture tutorials. Lectures will be captured using the [Lecture Online System](#). You'll be able to review / re-watch the slides and lectures afterwards on Canvas. Links for the recordings will appear in the Lectures Online tab on the Canvas page for this class. I will also post a PDF of the lecture slides.

### How do I succeed in this class?

The best way to succeed is to prepare and participate. Do the modules ahead of time, and take the time to watch them in full. When in class, buy in and **participate!** The green book is *your* textbook and you are the author. If you don't work hard on it, you won't have it to study from!

### How do I study for the unit exams?

- 1) Study the lecture tutorials. Don't just read them, re-do them! Cover your old answers, then check your new answers against them. Work in a group if you can!
- 2) Go over the in-class PDFs, and practice the think-pair-share questions from class and discussion boards.
- 3) Re-watch the relevant module videos, find concepts which you feel less secure on, find those concepts in the book, and read up.

4) Come to Drop-In Hours / Help Sessions!!!

### **I missed a unit exam, when can I make it up?**

There are no makeup exams. You will have the opportunity to do the optional Astronomy Project Assignment which will replace your lowest exam. The only exception to this will be:

- 1) If you have a major life event, **and you notify me ahead of time**. Depending on the situation, I may ask you to contact Student Emergency Services for assistance.
- 2) I am contacted by Student Emergency Services, and they request a makeup.
- 3) You are absent for a university-sponsored event, **and** you notify me ahead of time.

### **I'm sick, and can't come to class today, what do I do?**

**Depending on the case / issue, you don't need to email me! Stay home and get better** (you can miss 3-4 classes, and still receive a full participation grade). Still do the module before class (late submissions are not allowed), and after class, download the PDF to see what you missed. Do the missed lecture tutorials, in a group if you can find some classmates, or on your own. If you have to miss multiple consecutive classes, please contact me and Student Emergency Services, and they will let me know if they feel you should be allowed to make up for missed participation.

### **I need to leave class early? How do I make sure I don't lose participation?**

Participation is counted through InstaPoll. You will not receive credit for questions you miss, but there are plenty of built in class participation drops.

### **Its two days before the moon journal is due, and I haven't started!**

There's really nothing I can do to help you. Don't let this be you - make sure to start this early in the semester!

### **I got a zero in the gradebook for something I did or turned in!**

We can make mistakes when inputting 200 grades! If you believe there is a mistake in the gradebook, stay calm, just send myself or one of the TA's an email, and we'll investigate.

## **University Policies:**

**Academic integrity:** Each student in the course is expected to abide by the University of Texas Honor Code: "As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity." Plagiarism is taken very seriously at UT. Therefore, if you use words or ideas that are not your own (or that you have used in previous class), you must cite your sources. Otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT's Academic Honesty and the University Honor Code which can be found at the following web address: <https://deanofstudents.utexas.edu/conduct/standardsconduct.php>

- **Sharing of Course Materials is Prohibited:** No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I

am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

- **Class Video Recordings:** Class recordings are reserved only for the use of members of this class (students, TAs, and the instructor) and only for educational purposes and are protected under FERPA. Recordings should not be shared outside the class in any form. Violation of this restriction could lead to Student Misconduct proceedings.

**Personal or Family Emergencies:** If you experience a personal or family emergency (death in the family, protracted sickness, serious mental health issues) that prevents you from attending an exam or forces you to miss multiple days of classes, contact Prof. Finkelstein, and you should also contact Student Emergency Services in the Office of the Dean of Students <http://deanofstudents.utexas.edu/emergency/>. They will work with you to communicate with your professors and let them know of your situation.

**Core curriculum:** This course may be used to fulfill three hours of the natural science and technology component of the university core curriculum and your successful participation addresses the following four core objectives established by the Texas Higher Education Coordinating Board: communication skills, critical thinking skills, teamwork, and empirical and quantitative skills.

## Schedule of Topics / Due Dates (subject to some changes):

| Dates                         | Topics & Synchronous Class Meeting Activities   | Assignment Due Dates                    |
|-------------------------------|---|---|
| Week 1 - Aug. 22 / 24 / 26    | Monday: Intro/Overview, course goals; <i>Wed &amp; Friday:</i> activities on Position & Motion in the Sky | Module 1 materials due Friday Aug. 26th |
| Week 2 - Aug. 29/ 31, Sept. 2 | <i>Monday:</i> The Ecliptic; <i>Wed.</i> Path of the Sun; <i>Friday:</i> Seasons                          | Module 2 Materials due Friday 9/2       |
| Week 3 - Sept. 7 / 9          | <i>Monday:</i> Holiday no class or drop-in hours; <i>Wed. &amp; Friday:</i> Moon Phases                   | Module 3 Materials due Friday 9/9       |
| Week 4 - Sept. 12/14/16       | <i>Monday:</i> Ancient Astronomy; <i>Wednesday:</i> In-class review Exam 1; <i>Friday:</i> <b>Exam 1</b>  | <b>Exam 1 9/16</b>                      |
| Week 5 - Sept. 19/21/23       | <i>Monday:</i> Kepler; <i>Wed. &amp; Friday</i> activities on: Gravity & Newton                           |   |
| Week 6 - Sept. 26/28/ 30      | <i>Monday:</i> Intro to Light; <i>Wed.:</i> Telescopes; <i>Friday:</i> Nature of Light                    |   |
| Week 7 - Oct. 3/5/7           | <i>Monday:</i> Atoms & Spectra; <i>Wed.</i> Climate Change; <i>Friday:</i> Review for Exam 2              | <b>Citizen Science Project due 10/5</b> |

| <b>Dates</b>                      | <b>Topics &amp; Synchronous Class Meeting Activities</b>   | <b>Assignment Due Dates</b>                                      |
|-----------------------------------|--|--|
| Week 8 - Oct. 10/12/14            | <i>Monday: <b>Exam 2</b>; Wed. &amp; Friday activities on: Solar System &amp; Planet Formation</i> | <b>Exam 2 - 10/10</b>  |
| Week 9 - Oct. 17/19/21            | <i>Monday: The Sun &amp; Fusion; Wed. &amp; Friday activities on: Intro to Stars / Distances</i>   |  |
| Week 10 - Oct. 24/26/28           | <i>Monday: HR Diagram; Wed. &amp; Friday activities on: Stellar Evolution &amp; Black Holes</i>    |  |
| Week 11 - Oct. 31/ Nov. 2/4       | <i>Monday, Wednesday, &amp; Friday: Exoplanets</i>   |  |
| Week 12 - Nov. 7/9/11             | <i>Monday: <b>Review for Exam 3</b>; Wed. <b>Exam 3</b>; Friday - Intro to the Milky Way</i>       | <b>Exam 3 - 11/9</b>   |
| Week 13 - Nov. 14/16/18           | <i>Monday: Galaxies; Wed. Dark Matter; Friday Distant Galaxies / Expanding Universe</i>            | <b>Observing Project Due Friday 11/18</b>                        |
| Week 14 - Nov. 21-25              | <i>No Classes: Thanksgiving Break</i>  |  |
| Week 15 - Nov. 28/30 Dec. 2       | <i>Monday: / Hubble's Law, Wed. The Big Bang; Friday: Review for Exam 4</i>                        | <b>Moon Journal due in class Friday 12/2</b>                     |
| Week 16 - Dec. 5 (last class day) | <i>Monday: <b>Exam 4 (Dec. 5th)</b></i>  | <b>Exam 4 - 12/5</b> ; Optional Astronomy Project submit by 12/5 |