

Astronomy 218 - Spring 2022 Syllabus

Honors: Introductory Astronomy

Spring 2022 Semester

University of Tennessee, Knoxville

Course Details

Lecture

Instructor: Dr. Sean Lindsay E-mail: slindsay@utk.edu
(he/him/his)

Course Number: ASTR 218 (001 & 002)

Lecture Times: 11:45 AM - 12:35 PM Monday, Wednesday, and Friday (MWF)

Lecture Location: **PHY 304** in Nielsen Physics and Astronomy Building

Dr. Lindsay's Office: PHYS 215 in Nielsen Physics & Astronomy Building
Phone: 865-974-2362 (leave voicemail)

Zoom for Lecture: <https://tennessee.zoom.us/j/96221835232>

Office Hours: In-Office:
Tuesdays: 10 am – 12 pm or by Appointment
Wednesdays: 3 - 4 pm or by Appointment
Virtual: Available by appointment.
Zoom Link: <https://tennessee.zoom.us/j/94459095621>
(Different from above)
Passcode: **HB4861**

Course Textbook: “Foundations of Astrophysics” by Barbara Ryden & Bradley Peterson
Available from the VolShop Bookstore & online.

Recommended 100-level Book: Openstax's *Astronomy*

Link: <https://openstax.org/details/books/astronomy?Book%20details>

(Not required in any way for this course)

This and other 100-level textbooks are great for covering the basics of astronomy. They are still my first go-to when I want to review a topic. I then go into a book like Ryden & Peterson or Carrol and Ostlie.

Lab

Lab Instructor: JT Ternullo E-mail: jternull@vols.utk.edu

Lab Times: Section 001: 7:45 - 9:35 PM (Tuesdays)
Section 002: 7:45 - 9:35 PM (Tuesdays)

Lab Location: **PHY 108** in Nielsen Physics and Astronomy Building

Class Communication Apps

GroupMe: [Invite Link](#)

Discord Server: [Invite Link](#)

These will give you quick access to each other and to me. You can just have conversations or ask for clarification/help. I may make use of Discord for the Astronomy-themed Scenario. We may use both GroupMe and Discord, or we may not. I want to see what you prefer and what works best for our needs.

Course Description

Official UTK Description

Introduction to astronomy and astrophysics. Historical perspectives in understanding the celestial universe, with emphasis on the laws of physics as they apply to the changing conceptions of the universe; structure of the solar system and celestial motions; evolution and properties of stars; galactic structure and models of the universe; observational technique and interpretation of underlying physical laws in accompanying lab. The 217-218 sequence satisfies the College of Arts and Sciences' requirement for a natural science with laboratory.

Dr. Lindsay's Description

Astronomy 218 is an advanced introduction to astronomy and astrophysics. This class focuses on understanding stars, galaxies, the large-scale structure of the universe, and cosmology. An emphasis is placed on understanding fundamental concepts and being able to mathematically apply those concepts in ways used by professional astronomers. By the end of this course, you should have advanced in being able to solve multistep problems, think critically, and recognize how astronomical observations can be applied to understand the universe we inhabit. Mathematically, I have set the homework and exam bar at about the advanced algebra to pre-calculus level. The maths involved in the class will emphasize understanding of astrophysics and astronomical phenomena without losing the forest for the trees (Dr. Lindsay's hope). This class will also include an introduction to scientific literature reading and analysis.

The laboratory section focuses on reinforcing lecture topics and taking advantage of East Tennessee's infrequent clear nights through telescope observations. When the weather is good, you will use our telescopes to acquire images for astrophotography and photometry. The goal of the telescopic observations is to teach the fundamentals of observational astronomy, image reduction, and photometry.

Tentative Course Topics

The below are subject to change. There is a lot of material to cover, and I am not a fan of “a mile wide and an inch deep” style of teaching. I would rather cover less material more thoroughly than blast you with so much that you can’t absorb it all. When appropriate, I will review topics from Astronomy 217 (e.g., blackbody radiation, spectroscopy, Newtonian gravity, orbital mechanics, etc.).

- Properties of Stars (Chapter 13)
- Stellar Atmospheres (Chapter 14)
- Stellar Interiors (Chapter 15)
- The Interstellar Medium (Chapter 16)
- Formation and Evolution of Stars (Chapter 17)
- Stellar Remnants (Chapter 18)
- Our Galaxy - The Milky Way (Chapter 19)
- Galaxies (Chapter 20)
- Active Galaxies (Chapter 21)
- Clusters & Superclusters (Chapter 22)
- Cosmology (Chapter 23)
- History of the Universe (Chapter 24)

You can see that is A LOT of ground to cover - 12 chapters worth! We only have 14 weeks of full classes, so I will be cutting material as we progress. I will be sure to hit what I consider to be astronomy essentials at the expense of delving into some of the nitty gritty details. My goal is that you have a good understanding of *introductory* astronomy. *I did not cover some of the above topics until graduate school. The same was true for the majority of my graduate school classmates. We all were still able to be successful in our astronomy Ph.D. program.*

Course Policies in Brief

- Attendance is not taken, but it is highly encouraged. I will focus the homework and exams more on my own lecture notes rather than completely on the textbook. I will assign some textbook problems.
- When I assign reading, I expect you to complete the reading before class
- There will be two in-class exams (Exam 1 & Exam 2) and a final exam (structure of final is TBD). Each exam will count for 10% of your course grade
- There will be 8 - 10 homework assignments. All due dates for homework will be set to be the start of Wednesday’s lectures. Homework is 25% of your course grade.
- You will have several graded reading & writing assignments related to becoming familiar with scientific literature and communication. Cumulatively, these assignments will count for 10% of your course grade.

- Working by yourself or with a small group (max 3), you will be required to work through an imaginary scenario that will put your astronomy and problem solving skills to the test. This will count as 10% of your course grade.
- Your grade in the laboratory section of the class will count as 25% of your course grade.

Course Components

Homework Assignments

Homework will count for 25% of your course grade. I expect to create 6 - 8 homework assignments for you to work through this semester. (Number may change to balance out the workload with the more creative assignment categories)

Assignments will always be due on the start of a Wednesday class. You will hand in your hand-written homework, or you can submit an electronic scanned copy of them to Canvas. My plan is to hand grade all of your assignments. I think that is necessary for a course of this level.

I will assign homework assignments as we progress through the semester. You will always be given at least a week's worth of time to work on the homework, and when applicable, I will dedicate most or all of Friday lecture time to group work on the current homework assignment. I want you all to be able to work collaboratively, and also give you time and space to ask me for help to get you started on the homework. I will base many of my exam questions based on homework questions to keep things consistent and streamlined.

Homework questions will be a mix of questions from your textbook and ones that I write myself. You can work alone or in small groups, but you must turn in your own work. Clear cases of exactly the same solution will draw my attention, and in such cases, I will have to chat with you to make sure the work was done above board. A great way to personalize your work is to add phrases and sentences of explanation that walk you and me through your solution. Not all homework questions will be mathematical in nature.

Exams

We will have THREE exams: Exam 1, Exam 2, and a Final Exam. Each exam will be worth 10% of your course grade.

Exams will vary in number of questions, but will be designed to be completed within the 50-minute lecture period. Questions will include definitions, short answers, and math-based problems. Exam questions will be similar, but not identical, to homework questions. I will do my best to provide you with study guides.

Exams are closed book, but you are allowed to bring a single-sheet (front & back) equation sheet for the exams.

Understanding Scientific Literature Projects

We will have THREE assignments designed to get you used to reading and understanding scientific literature. In total, these will be worth 10% of your course grade.

We will approach this in stages and along a few different perspectives. You can find the instructions and due date of the four assignments here ([Link to Projects](#)). These projects are designed to get you familiar with how to find, read, and interpret high-quality astronomy science articles. This should give you the ability to start learning astronomy from non-textbook, primary sources. This is where the real science happens!

Imaginary Astronomy-themed Scenario

You will have to work through ONE Astronomy-themed Scenario that will involve multiple steps of applying your knowledge. This will be worth 10% of your course grade.

Working alone or in a small group (max 3), you will select an imaginary astronomy-themed scenario to work through. My goal is to have each scenario have branching pathways based on the decisions you make. Each step along the way will require to solve a question and make one or more decisions. Your task is to make it successfully to the end of the scenario. A catastrophic failure within the scenario will not result in a bad grade, as long as the disaster didn't occur from lack of work. You, however, will have to get to the end of the scenario for full credit.

This part of the class is experimental and a pilot run for a course I have dreams of creating. The general idea is every student plays the role of a character on an intergenerational spaceship on its way to establish the first extrasolar settlement. The class is highly interdisciplinary where you rank up skill points like (Physics, Chemistry, Biology, Sociology, Political Theory, etc.) by completing expertly crafted tests. Each semester of the class is unique in who the instructors and disciplines represented are. The semester proceeds by modular content and a series of "Accomplishment" and "Challenges" scenarios. If you are curious about more details of that course, please let me know. Unfortunately, I do not think it can be created with the UTK architecture.

Astronomy 218 Lab

Your grade in the lab portion of this course will be 25% of your course grade.

The laboratory section of this class is a combination of in-class exercises/experiments and telescopic observations. The goal is to have you using our telescopes as often as possible. This is highly weather dependent, so bear with us on that front. The in-class exercises are designed to help reinforce what we do in lecture. For the observational part, my goal is to have you learn the basics of observational astronomy. This will be accomplished through learning proper image acquisition and image reduction. Images will be both for astrophotography and for photometry. We are just starting to do photometry with our telescopes, so you all will get to pilot how successfully we can accomplish real observational astronomy from our rooftop. You will select a photometry project that you will work on over the course of the semester. Potential photometry projects include: 1) Cepheid variable light curves to determine

distances; 2) differential photometry of an open cluster of stars to determine temperatures and create an HR diagram; and 3) asteroid light curves.

Astronomy 218 Lecture

For lectures, I plan on using advanced versions of my Astronomy 152 lectures. I will supplement the foundational material with material from our textbook. My goal is to focus on the foundational concepts in astronomy. For the mathematical portion of the class, my focus will be on understanding the primary equations. This involves simple manipulation of them, understanding what is measured versus calculated by astronomers, and combining concepts to do multi step problem solving. I will NOT have you doing calculus in this class as it is not listed as a mandatory pre-/co-requisite (you can take this class with only pre-calc as a pre-/co-requisite).

I plan on lecturing on Mondays and Wednesdays. Fridays will be reserved for a variety of purposes, including additional lectures so we can get through the material, homework sessions, and other class activities to deepen the course. I have no set schedule yet since this is my first time teaching a class... and I'm just bad at schedules (a personal weakness and strength). Homework days will be days where you can work on the homework that would be due the following Wednesday. You can work in groups, on the whiteboard, and you have me as a resource to get help.

Course Grading

All grades are calculated according to the following grading weights and on the following grading scale.

Grade Category	Weight Percent
Exams	3 at 10% each Total: 30%
Homework	25%
Scientific Literature Projects	10%
Astronomy Scenario	10%
Astronomy 218 Lab	25%

The grading scale below is not fixed. I may revise it based on average homework and exam performance. Or rather, I may apply a curve to exams to make the grading scale below be fair.

Letter Grade	Percentage Range
A	90.00 or greater
A-	89.50 – 89.99%
B+	87.50 – 89.49%
B	80.00 – 87.49%
B-	79.50 – 79.99%
C+	77.50 – 79.49%
C	70.00 – 77.49%
C-	69.50 – 69.99%
D+	67.50 – 69.99%
D	60.00 – 67.49%
D-	59.50 – 59.99%
F	Less than 59.50%

Grade Rounding Policy: I do not round grades for any reason or special pleading. I offer enough points in this class for the decimal places to have meaning. I also offer an extraordinary amount of extra credit that you could have done to boost your grade. I use the extra credit and a 0.5% buffer earning you a “minus” grade at letter grade boundaries as my “grade rounding policy.”

[Cheating/Academic Dishonesty](#)

Cheating of any kind will not be tolerated. Consequences will vary depending on severity of violation. You all are honors students, so I please act accordingly.

[Other Course Information](#)

[Regarding Coronavirus and UTK](#)

With the spread of the Omicron variant of COVID-19, students, faculty, and staff are still at risk for becoming ill. Currently, UTK has no mask requirement. This requirement will remain so unless otherwise directed. Regardless of the lack of mandate, I respectfully request that if you wear a mask in-class and in-lab. Let’s please protect our family, friends, and community. I want my classroom to be one where respect is a foundational principle.

Please refer to the UTK Coronavirus – Information for Students page to be fully aware of responsibilities that apply to you personally, the faculty and staff, and the campus.

<https://www.utk.edu/coronavirus/students/>

The university strongly recommends that all members of the campus community be vaccinated for their own protection, to prevent disruption to the semester, and to prevent the spread of COVID-19. Vaccination information and appointment signups are available at

tiny.utk.edu/vaccine. The Student Health Center medical staff is available to students to answer

questions or discuss concerns about vaccines, and the center provides vaccines free of charge for anyone 18 years or older who would like one.

If you think you are sick or have been exposed to COVID-19, you should contact the Student Health Center or your preferred health care provider. You can also contact the university's COVID-19 support team for guidance by filling out the COVID-19 self-isolation form at covidform.utk.edu.

You must not attend class if you have tested positive for COVID-19 and are in the isolation period, if you have COVID-19 symptoms and have not been cleared by a medical provider, or if you are an unvaccinated close contact in the quarantine period.

If you need to miss class for illness, please contact Dr. Lindsay to let him know. He will do his best to arrange appropriate accommodations.

You can find more information and updates at utk.edu/coronavirus.

Student Issues

If you have any concerns that you would like me to know about, please see me or email me early in the semester. I understand that many of you have jobs, complicated family circumstances, private personal struggles, or a whole host of other factors that could affect your performance in this course. This is exacerbated by several orders of magnitude this semester. If you can let me know early, and before it becomes a problem in the course, I am almost always happy to work with you in order to foster an optimal educational experience. Please feel free to approach me during my office hours or via email.

Technology Concerns

If you are having any limitations due to technology, please let me know as early as you can. I am collecting a set of resources that UTK is providing. Until I have that gathered and released, please contact UTK OIT (<https://oit.utk.edu/>) and ask how they might be able to help you. I will work with you from my end while solutions are found.

Student Disability Service

I always work fully with the Student Disability Services (SDS: <https://sds.utk.edu/> or by phone at 875-974-6087) in 915 Volunteer Blvd/100 Dunford Hall. If you have a known or suspected disability, please contact SDS to establish accommodations. The offices have a wonderful staff that are extraordinarily helpful. If you do have SDS accommodations, they will let me know, but I encourage you to contact me to discuss how we can work with the accommodations to make your astronomy experience the best for your needs.