



TEXAS TECH UNIVERSITY

Department of Physics & Astronomy™

Box 41051
Science 101
Lubbock, TX 79409-1051

ASTR-1401 STELLAR ASTRONOMY (Spring 2018)

WHY THIS COURSE?

Our species needs, and deserves, a citizenry with minds wide-awake and a basic understanding of how the world works. -- Carl Sagan

This course will also satisfy a four-hour laboratory science requirement. It is intended both for students who are interested in astronomy and for those who are not necessarily “science-oriented” but still need to satisfy a science requirement. Science is more important in our daily lives than ever before – scientific reasoning will play a large role in this course.

LEARNING OBJECTIVES

- Developing a grasp of the key features of the universe, its scale, our place in it, and the physical principles relevant to astronomy.
- Understanding how we know what we know about the vast universe.
- Applying quantitative reasoning to solve variety astronomical and practical problems.
- Describing and explaining natural phenomena using the scientific method.
- Developing critical thinking skills that can be applied to life outside the classroom.

KEY TOPICS

- Our place in the universe, scales, distances, motions.
- Basic principles of physics that allow astronomers to learn about the universe.
- Telescopes, satellites, and space probes.
- Stars and their lifecycles: low mass stars, high mass stars, our sun, stellar graveyard.
- Galaxies, Milky Way, the expansion of the universe.
- Life on Earth and beyond.

ASSESSMENT

Students’ understanding of the learning goals will be evaluated from selected questions on homework assignments, in-class activities, and exams.

COURSE PREREQUISITES

While there is no prerequisite for this class, you will be expected both on the homework and in the exams to be able to perform simple mathematical calculations. Examples of the mathematical concepts we will use in this class are: scientific notation, multiplying and dividing powers of 10, converting between different metric units, rearranging and solving simple equations. It will be assumed that you know how to use a non-programmable scientific calculator, and that you are familiar with high school algebra and trigonometry.

COURSE AND INSTRUCTOR INFORMATION

- Course Time: MWF, 11:00-11:50 am
- Course Location: Chemistry room 107, TTU campus

- Instructor: Prof. Alessandra Corsi
- Instructor's address: Science Building room 17, TTU campus
- Instructor's phone: +1-806-834-6931
- Instructor's e-mail: alessandra.corsi@ttu.edu
- Office hours: TBC Monday 3-4 pm; Tuesday 4-5 pm
- LAB coordinator contact info: Gwen Armostrong, gwen.armstrong@ttu.edu

REQUIRED TEXTBOOKS AND SUPPLIES

21st Century Astronomy STARS AND GALAXIES - 5th edition with Smartwork5 and video game - Authors: Kay, Palen, Blumenthal; Publisher: Norton. I recommend purchasing the e-book bundle or loose-leaf bundle (these bundles are available at the TTU on-campus bookstore; the e-book bundle can also be purchased directly from the publisher's website <https://digital.wwnorton.com/astro5star>).

- **Astronomy 1401 Lab Manual** produced by the Texas Tech Department of Physics. Lab Manual Sales: on-campus bookstore and Varsity. You **MUST** purchase a lab manual in a timely manner.
- **Turning Technologies response card RF LCD (clicker) and Turning Account license**. These can be purchased as a bundle. The TTU bookstore as well as other bookstores around campus (Neebo, Red & Black College Bookstore, and Varsity) have clickers available. You **MUST** purchase a clicker and license in a timely manner, and register them on BB (see instructions in what follows). During the first week of class, we will test the clickers so that all students can become familiar with the device. Starting from the second week of class, in-class activities using clickers will be graded for participation.
- A non-programmable scientific calculator.
- Your Texas Tech Student ID (required for all classes and exams).

WEB TOOLS

- **Blackboard:** <http://ttu.blackboard.com/> The course webpage is (or will soon be) on the Blackboard (BB) system. Course announcements will be posted on this site. BB will also be used for electronic communications, and to post other relevant course material (such as homework solutions, grades, etc.).
- There will be several homework sets assigned via Smartwork5 during the course of the semester. Smartwork5 can be accessed via <https://digital.wwnorton.com/astro5stars> using the student set **ID 49159**.

CLICKER REGISTRATION AND FAQs

To register your clicker via blackboard, follow these instructions:



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- 1) Log into Blackboard.
- 2) Click the Courses tab.
- 3) Select the appropriate course under Course List.
- 4) From the left menu, click Turning Account registration.
- 5) Enter your TTU email address and click “create an account”.
- 6) Check your email and click the verification link.
- 7) Enter all the required fields and click finish.
- 8) Enter the **Device ID** and click Register. The device ID is the six-character hexadecimal Device ID located on the back of the ResponseCard below the barcode (see picture above).
- 9) Enter the **License Code** and click Register.
- 10) Click Finish. After this step the turning account dashboard is displayed and you should see a green check mark for Device.

Note that your device ID is uniquely associated with your name. You should use one and only one clicker during this course. **You will receive a zero for any in-class activity you missed because you did not have your clicker available or working properly, or because your clicker is not registered as yours on BB.** If your clicker is not working properly and/or you need to associate a new device ID with your name, you should contact the instructor **before class starts**. Last minute requests for clicker ID changes during class time will not be accommodated. If you are unsure whether your clicker is working, you should **test it with the instructor before the start of class**.

Here are a few FAQs (more info at <http://www.turningtechnologies.com/>):

- *Why does the ResponseCard flash different colors?*
Green: Confirmation that the RF Receiver has received a response from the ResponseCard. Orange: The ResponseCard is sending a signal and waiting for confirmation from the RF Receiver. Red: Response not received by the RF Receiver. Green and Red: In Channel Changing mode.
- *I've registered my ResponseCard but it flashes orange and my responses are not recorded?*
If your ResponseCard is on the wrong channel it will flash orange/yellow for 8 seconds. On the 9th second it will turn red. Try changing the channel on the ResponseCard. The default channel is 41. To reset your ResponseCard to e.g. channel 41, press Go-4-1-

Go. When you correctly program the ResponseCard, the light will turn green. You may join the correct channel prior to entering class as well.

CLASS PREPARATION

Students are expected to keep up with the material and to not fall behind. It will be assumed that you have tried to look over the relevant text material before the corresponding lecture, so that the lecture can serve as a concentrated review and clarification, with time for discussion of clicker questions. If you are coming to class “cold,” without having skimmed the material in the text, you will find yourself at disadvantage.

HOMEWORK ASSIGNMENTS

- There will be several homework sets assigned via Smartwork5 during the course of the semester. These are listed (together with the corresponding due dates) in the detailed course schedule included in this syllabus. Homework assignments are worth 20% of your final numerical course grade.
- Smartwork5 can be accessed via <https://digital.wwnorton.com/astro5stars> using the student set **ID 49159**.
- More detailed instructions for registering on Smartwork5 and accessing the homework for this course are available on blackboard.
- Do not wait until the end of the time period given to complete the assignment. **Any technical problems with a computer or Internet access are not acceptable excuses for late or incomplete work.** All Smartwork5 homework is **due by 11:59 pm on the due date**. There is a penalty of 20% for each day the assignment is late, after this, no late work will be accepted.

QUIZZES / IN-CLASS ACTIVITIES

- Quizzes or other in-class work (administered using clickers) will be given during classes, with the primary purposes of giving you an opportunity to review the material, and giving the instructor the opportunity to check your comprehension of it. The in-class work is worth 10% of the course grade. You may need to make calculations, so you should always bring a working non-programmable scientific calculator to class.
- Your clicker should be uniquely associated to yourself, and you must never use another student’s clicker. Violations to this policy are taken very seriously (please see the academic integrity section).
- The number of graded activities per class is at the discretion of the instructor. **You will receive a zero for each in-class activity you miss.** However, the three in-class activities with the lowest grade will be dropped from your final grade as a way to cover for illness and extraordinary situations. Given this lenient policy, please do not contact the instructor to make up this in-class work unless you have a serious ongoing problem (e.g., **your car not starting, getting stuck in traffic, or documented illness that does not require hospitalization do not qualify**).



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LABORATORY

- There is a required laboratory worth 25% of the course grade. You will receive one grade for the lecture and the laboratory combined – they are not separate courses. **If you fail the laboratory portion of this class, you will fail this course.**
- In addition to the weekly lab meetings, you have the opportunity to visit the Texas Tech Observatory for some nighttime observations as part of your lab grade. These observational exercises are **not** optional.
- All necessary information regarding these activities will be posted on the observatory website (linked from the Texas Tech Department of Physics homepage); it will also be discussed by your laboratory instructor during the first week of class.
- If no lab is listed on your schedule, see your professor immediately. **Questions about the laboratory should be addressed to your laboratory instructor, not the lecturer.**

GRADE DISTRIBUTION

Your **final numerical course grade** will be calculated as a weighted average of:

- Midterm Exam (lowest dropped): 20% weight
- Final Exam: 25% weight
- Homework assignments (total): 20% weight
- Quizzes / in-class activities (total, lowest three dropped): 10% weight
- Laboratory/Observing: 25% weight

Numerical course grades will be converted into letter grades according to the following scale (**No extra credit will be given**):

Numerical course grade	Letter grade
$\geq 90.00\%$	A
80%-89%	B
70%-79%	C
60-69%	D
$< 60\%$	F

MIDTERM EXAM POLICY

- There will be two midterm exams, however, the grade on the lower exam will be dropped. The midterm exam with the highest grade is worth 20% of the final numerical course grade. **Because the lowest midterm exam is dropped, there is no make-up day for the midterm exams.**

- The midterm exam will cover material up to the date of that exam, it will be administered in the lecture room, and you will need to bring a non-programmable scientific calculator, a #2 pencil (with eraser), and your Texas Tech ID.
- If you are caught using non-authorized material (notes, textbooks, cell phones, laptops, etc.) during the exam, the minimum penalty will be: (i) a zero on the exam; (ii) no bonuses (lowest three in-class activities will NOT be dropped). You may also be sent to student conduct and/or subject to additional penalties.

FINAL EXAM POLICY

- There will be one final exam worth 25% of the final numerical course grade. The final exam is comprehensive, and you will need to bring a non-programmable scientific calculator, a #2 pencil (with eraser), and your Texas Tech ID.
- If you are caught using non-authorized material (notes, textbooks, cell phones, laptops, etc.) during the exam, the minimum penalty will be: (i) a zero on the exam; (ii) no bonuses (lowest three in-class activities will NOT be dropped). You may also be sent to student conduct and/or subject to additional penalties.
- **There is no make-up day for the final exam: the Final Exam is mandatory.** Our final exam WILL BE **ON TUESDAY 2018 MAY 15**, 7:30-9:30 am. For this reason, DO NOT PLAN TO LEAVE TTU ON OR BEFORE THIS DATE.
- TTU's policy regarding final exams states:
 1. ALL Final Exams must be given at the assigned time. **They may not be given prior to the officially assigned time.**
 2. If a student misses their Final Exam, they must contact their Instructor. This is a matter between the student and the Instructor. The policy for this class is that **no make-up Final Exams will be given except in the event of severe documented illness.**
 3. There is no policy on how many Final Exams a student can have in one day. The Final Exam Schedule was posted in the Schedule of Classes and must be followed.

For more info about the final exam policy, please visit:

<http://www.depts.ttu.edu/opmanual/OP34.10.pdf>

CLASS POLICIES

- **Cell phones, laptops, etc. are NOT ALLOWED in class.** If you use a cell phone and/or iphone and/or a personal laptop, ... etc. during class time, disturbing the lecture and/or distracting other students, **you will be asked to leave class and not return that class period.** Do not rely on your cell phone for calculations. If you have a legitimate reason for needing a laptop during class time, please speak to the instructor.



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- **Illness:** If **severe** illness occurs, seek treatment immediately, contact instructor when possible, and stay home. When you return and once you have provided proper documentation, we will make arrangements for missed work on an individual basis. Note that illness that does not require hospitalization is not an excuse for missing homework (since you have at least a week to complete each homework), midterm exams (since the lowest midterm exam is dropped), or for missing in-class activities (since you are already allowed three absences). **In case of an illness that will require absence from class for more than one week, the student should notify his or her academic dean.**

DETAILED COURSE SCHEDULE

(Subject to change with notice)

Wk	Class	Dates	Topic	Chap	Assignments
	1-F	19 Jan	Introduction, Our cosmic address	1.1	HW#1 assigned (ch 1,2)
1	2-M	22 Jan	Scales, scientific method	1.1, 1.2	
	3-W	24 Jan	Intro to the LAB	LAB manual	
	4-F	26 Jan	Powers of 10, graphs	1.3	
2	5-M	29 Jan	Motions of Earth, seasons	2.1, 2.2	
	6-W	31 Jan	Moon's appearance	2.3	
	7-F	2 Feb	Heliocentric model	3.1	
3	8-M	5 Feb	Kepler's laws	3.2	
	9-W	7 Feb	Galileo and Newton	3.3,3.4	HW#1 due (ch 1,2) HW#2 assigned (ch 3)
	10-F	9 Feb	Gravity	4.1	
4	11-M	12 Feb	Gravity	4.2	
	12-W	14 Feb	Light	5.1	HW#2 due (ch 3) HW#3 assigned (ch 4)
	13-F	16 Feb	Spectra and Doppler shift	5.2, 5.3	
5	14-M	19 Feb	Blackbody, brightness	5.4,5.5	
	15-W	21 Feb	Optical telescopes	6.1	HW#3 due (ch 4) HW#4 assigned (ch 5)
	16-F	23 Feb	Optical detectors	6.2	
6	17-M	26 Feb	Beyond the visible	6.3, 6.5	

	18-W	28 Feb	Properties of stars	13.1, 13.2	HW#4 due (ch 5)
	19-F	2 Mar	HR diagram	13.4	
7	20-M	5 Mar	Review for exam #1	1,2,3,4,5,6	
	21-W	7 Mar	Exam #1	1,2,3,4,5,6	
	22-F	9 Mar	Star masses	13.3	HW#6 assigned (ch 13)
8	23-M	12 Mar	Spring Break (NO CLASS)		
	24-W	14 Mar	Spring Break (NO CLASS)		
	25-F	16 Mar	Spring Break (NO CLASS)		
9	26-M	19 Mar	Our star the sun	14.1, 14.2	
	27-W	21 Mar	Solar atmosphere	14.3	HW#6 due (ch 13)
	28-F	23 Mar	Solar activity	14.4	HW#7 assigned (ch 14)
10	29-M	26 Mar	Low mass stars	16.1, 16.2	
	30-W	28 Mar	Helium burning	16.3	
	31-F	30 Mar	White dwarfs, binaries	16.4, 16.5	HW#8 assigned (ch 16) HW#7 due (ch 14)
11	32-M	2 Apr	NO CLASS		
	33-W	4 Apr	High mass stars	17.1	
	34-F	6 Apr	Massive star explosions	17.2, 17.3	
12	35-M	9 Apr	Star clusters	17.4	
	36-W	11 Apr	Black holes	18.4	HW#8 due (ch 16) HW#9 assigned (ch 17,18)
	37-F	13 Apr	Galaxies	19.1, 20.1	
13	38-M	16 Apr	Distance ladder	19.2	
	39-W	18 Apr	Dark matter, AGNs	19.3, 19.4	HW#8 due (ch 17,18) HW#9 assigned (ch 19/20)
	40-F	20 Apr	History and future of the Milky Way	20.4	
14	41-M	23 Apr	Cosmological principle, Big Bang	21.1, 21.2	
	42-W	25 Apr	Redshift	21.3	HW#9 due (ch 19/20)
	43-F	27 Apr	CMB	21.4	HW#10 assigned (ch 21)
15	44-M	30 Apr	Review for Midterm #2	13,14,16,17/18,19/20	
	45-W	02 May	Exam #2	13,14,16,17/18,19/20	



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	46-F	04 May	Searching for life	24.3, 24.4	HW#10 due (ch 21)
16	47-M	07 May	Review for Final Exam	All covered	
		15 May 7:30-9:30 a.m	FINAL EXAM	All covered	

ACADEMIC INTEGRITY

I support the TTU Code of Student conduct. Essentially, it states: "It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. **The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense** and renders the offenders liable to serious consequences, possibly suspension."

If cheating, use of non-authorized material, improper use of clickers (such as using another participant's device), or any other form of academic dishonesty is suspected on a HW assignment, in-class activity, LAB, or exam, a case will be opened with the office of student conduct. If it is determined that academic dishonesty has indeed occurred, the MINIMUM penalty will be:

- (i) A zero on the assignment / exam/ LAB;
- (ii) No bonuses (lowest three in-class activities will NOT be dropped);
- (iii) Additional penalties as established by the office of student conduct.

For more info, consult the code of conduct: <http://www.depts.ttu.edu/opmanual/OP34.12.pdf>

RELIGIOUS HOLI DAYS

Texas law requires institutions of higher education to excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holiday. The student shall also be excused for time necessary to travel. An institution may not penalize the student for the absence and allows for the student to take an exam or complete an assignment from which the student is excused. While no prior notification of the instructor is required, OP 34.19 indicates that a student who intends to observe a religious holiday should make that intention known to the instructor prior to the absence. The student should make up any missed work. For more information, please visit:

<https://www.depts.ttu.edu/opmanual/OP34.19.pdf>

DISABILITY SERVICES

<http://www.depts.ttu.edu/opmanual/OP34.22.pdf>

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in 335 West Hall or call 806.742.2405.

UNIVERSITY COUNSELING AND RESOURCES FOR DISCRIMINATION, HARASSMENT, AND SEXUAL VIOLENCE

The university experience can be a time of substantial growth for students, filled with changes, challenges and new decisions. Few students move through this time without some personal turbulence, and many experience periods of trauma, crisis, stress, and confusion. The Student Counseling Center staff is available to help students with any problems they may be experiencing. For more information, please visit: <http://www.depts.ttu.edu/scc/>

Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other Title IX violations are not tolerated by the University. Report any incidents to the Office for Student Rights & Resolution, (806)-742-SAFE (7233) or file a report online at titleix.ttu.edu/students.

Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are:

- TTU Student Counseling Center, 806-742-3674, <https://www.depts.ttu.edu/scc/> (Provides confidential support on campus.)
- TTU Student Counseling Center 24-hour Helpline, 806-742-5555, (Assists students who are experiencing a mental health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.)
- Voice of Hope Lubbock Rape Crisis Center, 806-763-7273, voiceofhopelubbock.org (24-hour hotline that provides support for survivors of sexual violence.)
- The Risk, Intervention, Safety and Education (RISE) Office, 806-742-2110, rise.ttu.edu (Provides a range of resources and support options focused on prevention education and student wellness.)
- Texas Tech Police Department, 806-742-3931, <http://www.depts.ttu.edu/ttpd/> (To report criminal activity that occurs on or near Texas Tech campus.)

SECURITY

It is very important that you familiarize yourself with the emergency procedures for evacuation, fire, flood, medical, violence and workplace threats, and tornado. You can find these procedures at the following link:

<http://www.depts.ttu.edu/communications/emergency/procedures.php> In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location. When clear of the building please continue away from the building and meet class Instructor at Memorial Circle.

EMERGENCY NOTIFICATIONS AND ALERTS

TechAlert! is the principal method that the University uses to communicate emergency situations and class cancellations or delays. If you have not already done so this semester, update cell phone, home phone or text message information at: <https://appserv.itts.ttu.edu/EmergencyAlert/>



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Astronomy 1401 Spring 2018 Lab Schedule

<u>Week</u>	<u>Date</u>	<u>Topic and Experiment</u>
I	1/22 – 1/26	WEEK OF NO LABS.
II	1/29 – 2/2	Introduction to ASTR 1401 Laboratory.
III	2/5 – 2/9	Extending the Scale
IV	2/12 – 2/16	Parallax
V	2/19 – 2/23	Spectroscopy
VI	2/26 – 3/2	Hertzsprung-Russell Diagram
VII	3/5 – 3/9	WEEK OF NO LABS
VIII	3/12 – 3/16	SPRING BREAK.
IX	3/19 – 3/23	Calculating the Lifetime of the Sun
X	3/26 – 3/30	Ages of Star Clusters
XI	4/2 – 4/6	Variable Star Photometry
XII	4/9 – 4/13	Galaxy classifications
XIII	4/16 – 4/20	The Cosmic Distance Ladder
XIV	4/23 – 4/27	Grade Return

OFF CAMPUS LABS: Naked Eye Observing
Observing with a Telescope

Astronomy 1401 Lab Includes:

- A series of nine indoor labs, with associated pre-labs, your pre-lab must be completed prior to coming to lab.
- Two outdoor evening observing sessions with associated pre-labs at the Texas Tech observatory. You will sign up for these sessions on the astronomy website and there are several dates for each lab so you can find one that matches your schedule.

This lab is a required adjunct to Astronomy 1401. Attendance to the lab is crucial. **All work will be completed at the time of the lab/viewing session and turned in before you leave.**

The labs held in Sc 121 are designed to be interesting and challenging—please be sure to read over the lab to get the basic idea beforehand! If you are more than 15 minutes late to your lab in Sc 121 or your observing session, you will be sent home.

You must have your lab manual in order to complete your work. **Students who do not have their manual, or have not completed their pre-lab exercise will not be allowed to stay and complete the lab.**

Any student, who, because of a disability, may require special consideration in order to meet the course requirements, should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during lab time. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in West Hall or call 806-742-2405.

Students will foster a spirit of academic integrity, and they will not present work as their own that was not honestly preformed by them. Penalties range from a 0 for the day's work to an F for the overall course.