



TEXAS TECH UNIVERSITY

Department of Physics & Astronomy™

Box 41051
Science Building 26
Lubbock, TX 79409-1051

ASTR-1400 SOLAR SYSTEM ASTRONOMY

(Spring 2020 – Dr. Vallia Antoniou)

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

Broadly, after completing this course students will be able to:

- Identify and describe the features of our Solar System and the physical principles relevant to astronomy.
- Apply quantitative reasoning to solve a variety of astronomical and practical problems.
- Recognize Science as a process and summarize how astronomical data is acquired and understood.
- Develop 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.
- Formation of planetary systems.
- Our Solar System: planets, moons, and rings.

ASSESSMENT

Students’ understanding of the learning goals will be evaluated from selected questions on homework assignments, in-class activities, labs, 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 (e.g., if $v = H * d$, solve for d given v and H). 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, 1:00-1:50 pm
- Course Location: Media & Communications 0281, TTU campus
- Instructor: Dr. Valsamo (“Vallia”) Antoniou
- Instructor’s address: Science Building room 26, TTU campus
- Instructor’s phone: +1-806-834-5790
- Instructor’s e-mail: vallia.antoniou@ttu.edu
- Office hours: MWF 2:15pm – 3:30pm (or by appointment in cases of ongoing schedule conflicts; please contact the instructor via email at least 24 hours ahead of time to agree on a time)
- LAB coordinator contact info: Gwen Armstrong, gwen.armstrong@ttu.edu

IMPORTANT DATES

- *January 31* - Last day to drop a course without academic penalty
- *February 12* - Last day to withdraw and receive partial financial credit
- *April 22* - Last day to drop a course with academic penalty (counts against drop limit).

Please go to the official TTU 2019—2020 calendar for more information on dates and deadlines: https://www.depts.ttu.edu/officialpublications/calendar/19-20_cal_onepage.pdf

TEXTBOOKS AND SUPPLIES

➤ **Required:**

- **Astronomy 1400 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.*
- **Online Homework System**
Smartwork5
Publisher: WW Norton
- **A non-programmable scientific calculator.**
- Your **Texas Tech Student ID** (required for all classes and exams).
- **Orange scantron, pencil, and eraser** for all exams.

➤ **Recommended:**

- **Lecture Response System**
Turning Point by Turning Technologies 1 Semester License, ISBN: 9780997224863
Available in the TTU Campus Bookstore or online from the publisher. Note: You should not buy a clicker device, you will use Turning Point as an app on your smartphone or laptop.
- **Textbook**
 - **21st Century Astronomy THE SOLAR SYSTEM 6th edition - eBook or loose leaf (whatever you prefer) with Smartwork5** – Authors: Kay, Palen, Blumenthal; Publisher: Norton. Available at the TTU on-campus bookstore; the **e-book plus smartwork5 bundle** can also be purchased directly from the publisher’s website at <https://digital.wwnorton.com/astro6>
If you choose to buy a physical copy, be sure it comes with a valid code for Smartwork5.

OR

- **OpenStax Astronomy** – Free online book found at:
<https://openstax.org/details/books/astronomy>

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 lecture notes, grades, etc.). Please check BB and your Texas Tech email at least once a day to ensure you are not missing important course information.
- There will be several homework sets assigned via Smartwork5 during the course of the semester. Smartwork5 is an online, self-graded homework system that provides students with interactive, engaging content, and it can be accessed via <https://digital.wwnorton.com/astro6> using the Student Set ID (also referred to as Enrollment Key) **212660**.

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. If you are coming to class “cold,” without having skimmed the material in the text, you will find yourself at disadvantage.

CLASS ATTENDANCE

Both a privilege and a responsibility: You are advised to attend **ALL** lectures (a) Students are more likely to succeed in academics when they attend lectures consistently, and (b) It is difficult for the instructor and the class to build their skills and progress if a large number of

students is frequently absent. There are Extra Credit opportunities related to consistent attendance (see details below under “In-class participation”).

HOMEWORK ASSIGNMENTS

- There will be several homework sets assigned via Smartwork5 during the course of the semester. Smartwork5 is an online, self-graded homework system that provides students with interactive, engaging content. The homework sets are listed (together with the corresponding due dates) in the detailed course schedule included in this syllabus. Homework assignments are worth 25% of your final numerical course grade.
- Smartwork5 can be accessed via <https://digital.wwnorton.com/astro6> using the student set ID (also referred to as Enrollment Key) **212660**.
- 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/incomplete work.** All Smartwork5 assignments are **due by 11:59 pm Central Time on their due date. There is a 10% penalty for each day the assignment is late for up to one week**, after this, no late work will be accepted.

LABORATORY

- There is a required laboratory worth 25% of the course grade. You will receive one grade for the lecture and the laboratory combined – these 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 TTU Skyview Observatory, officially the Preston F. Gott Skyview Observatory, for some nighttime observations as part of your lab grade. These observational exercises are **not** optional. Note also that transportation to the TTU Skyview Observatory will **not** be provided: it is the student’s responsibility to arrive at the Observatory on time via personal transportation (carpooling is strongly encouraged!).
- All necessary information regarding these activities will be discussed by Gwen Armstrong, the laboratory coordinator (scheduled for 01/24/2020), and will be posted here <http://www.phys.ttu.edu/~gwen/index.htm> and here http://www.depts.ttu.edu/phas/Academics/Preston_Gott_Observatory/index.php. This page contains the sign-forms for the observing labs and other related information.
- Observatory Twitter Feed: <https://twitter.com/AstronomyTTU>
Lab changes and cancellations will be posted to this Twitter feed.
- If no lab is listed on your schedule, see your instructor immediately. **Questions about the laboratory should be addressed to your laboratory coordinator, not the instructor.**
- **LABs will start on the week of Jan 27, 2020.**

IN-CLASS PARTICIPATION

This course takes a student-centered, active learning approach. You will get much out of the class if you actively participate. During most class sessions, multiple electronic poll questions will be asked. Your participation grade will be based on a percentage of in-class Turning Point (clicker) questions you answer with the lecture response system.

LECTURE RESPONSE SYSTEM

You will need to purchase a license for the Turning Point Lecture and log into the session for each class with a session ID code. This ID code will be different for each session and may not be shared with anyone who is not physically present in the classroom. Any student who shares the code with an absent student or uses a session code when not present will immediately lose 10% of final grade, will be reported to the Office of Student Conduct, and may face more sanctions at the instructor's discretion, including a failing course grade. Don't share session codes with your absent friends, you won't be helping them!

GRADE DISTRIBUTION

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

- Midterm Exam (lowest dropped): 25% weight
- Final Exam: 25% weight
- Homework assignments (total): 25% weight
- Laboratory/Observing: 25% weight

- *Participation extra credit: up to 3%. **No further opportunities for extra credit will be granted during the semester.***

Final grades will be calculated and rounded to the nearest whole point. Numerical course grades will be then converted into letter grades according to the following scale:

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 3 midterm exams, however, the grade on the lowest midterm exam will be dropped. The average of the two midterm exams with the highest grades is worth 25% 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 an orange scantron, a non-programmable scientific calculator, a #2 pencil (with eraser), and your Texas Tech ID.

- Your cell phones must remain stored in your bag or pocket and cannot be used as pocket calculator. If you need to use the restroom, you must leave your phone with the instructor. Your phone will be returned after the exam.
- If you are caught using non-authorized material (notes, textbooks, cell phones, laptops, etc.) during the exam, you will receive a zero on the exam. 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 an orange scantron, a non-programmable scientific calculator, a #2 pencil (with eraser), and your Texas Tech ID.
- Your cell phones must remain stored in your bag or pocket and cannot be used as pocket calculator. If you need to use the restroom, you must leave your phone with the instructor. Your phone will be returned after the exam.
- If you are caught using non-authorized material (notes, textbooks, cell phones, laptops, etc.) during the exam, you will receive a zero on the exam. 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 **Thursday May 07 2020, from 1:30 p.m. to 4:00 p.m.** 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 requiring hospitalization on the day of the Final Exam.**
 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.
https://www.depts.ttu.edu/officialpublications/class_schedule/fall_class.php
 For more info about the final exam policy, please visit:
<http://www.depts.ttu.edu/opmanual/OP34.10.pdf>

CLASS POLICIES

- **Cell phones, tablets, laptops, headphones, and other electronic devices are generally NOT ALLOWED in class.** You can use your smartphone, tablet, or laptop *only* when required by your instructor so you can participate in in-class activities administered via the Turning Point App. If you do not have access to one of the above devices for use in this course, please contact the instructor as soon as possible. These devices should *only* be used for lecture responses, and class-related materials. If you have a legitimate reason for needing a tablet/laptop during class time (e.g. taking notes), please speak to the instructor. It is recommended to turn off notifications, log

out of email and social media, and silence your smartphones to avoid distraction. Keep in mind that tablets and laptops can be especially distracting for other students near you. If your use of technology is disturbing the lecture and/or distracting other students, you will be asked to put it away or leave the class and not return that class period.

- **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 attendance is not mandatory). **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 as the semester progresses)

Week	Class-Day of week	Date	Topic	Chapter	Assignments/ Important notes
1	1-W	15 Jan	Introduction, Our cosmic address	1.1	
	2-F	17 Jan	Scales, scientific method, powers of 10	1.1, 1.2	HW#1 assigned (Ch 1)
	3-M	20 Jan	MLK Day NO CLASS	--	
2	4-W	22 Jan	Motions of Earth, Seasons	2.1, 2.2	
	5-F	24 Jan	Intro to the LAB, Graphs	LAB manual, 1.3	
	6-M	27 Jan	Moon's appearance	2.3	HW#1 due (Ch 1) HW#2 assigned (Ch 2) LAB starts this week!
3	7-W	29 Jan	Heliocentric model	3.1	
	8-F	31 Jan	Kepler's laws	3.2	
	9-M	3 Feb	Galileo & Newton	3.3, 3.4	HW#2 due (Ch 2) HW#3 assigned (Ch 3)
4	10-W	5 Feb	Gravity, mass, weight	4.1	
	11-F	7 Feb	Newton's law of gravity	4.1	
	12-M	10 Feb	Review for Midterm Exam #1	1,2,3	HW#3 due (Ch 3) HW#4 assigned (Ch 4)
5	13-W	12 Feb	Midterm Exam #1	1,2,3	(Vallia absent)
	14-F	14 Feb	Gravity and orbits	4.2	
	15-M	17 Feb	Light	5.1	HW#4 due (Ch 4) HW#5 assigned (Ch 5)

6	16-W	19 Feb	Spectra and Doppler shift	5.2, 5.3	
	17-F	21 Feb	Blackbody, brightness	5.4, 5.5	
	18-M	24 Feb	Optical telescopes	6.1	HW#5 due (Ch 5) HW#6 assigned (Ch 6)
7	19-W	26 Feb	Beyond the visible	6.3, 6.5	
	20-F	28 Feb	Planet formation, Solar System tour	7.1, 7.2	
	21-M	2 Mar	Properties of Exoplanets, Revisiting nebular theory	7.3, 7.4	HW#6 due (Ch 6) HW#7 assigned (Ch 7)
8	22-W	4 Mar	Favorite exoplanets	7.5	
	23-F	6 Mar	Impacts & craters, Radioactive dating	8.1, 8.2	
	24-M	9 Mar	Internal heat, tectonism	8.3, 8.4	HW#7 due (Ch 7) HW#8 assigned (Ch 8)
9	25-W	11 Mar	Review for Midterm Exam #2	4,5,6,7	
	26-F	13 Mar	Midterm Exam #2	4,5,6,7	
	27-M	16 Mar	Spring break NO CLASS	--	
10	28-W	18 Mar	Spring break NO CLASS	--	
	29-F	20 Mar	Spring break NO CLASS	--	
	30-M	23 Mar	Volcanism, erosion, terrestrial exoplanets	8.5, 8.6	
11	31-W	25 Mar	Atmospheres & magnetospheres of terrestrial planets	9.1, 9.2	
	32-F	27 Mar	Planetary temperatures, Earth vs. Venus	9.3, 9.4	HW#8 due (Ch 8) HW#9 assigned (Ch 9)
	33-M	30 Mar	Properties of gas giants	10.1	
12	34-W	01 Apr	Atmospheres & interiors of gas giants	10.2, 10.3	
	35-F	03 Apr	Regular vs. irregular moons, Moons of our Solar System	11.1, 11.2	HW#9 due (Ch 9) HW#10 assigned (Ch 10, 11)
	36-M	06 Apr	Moons of Jupiter & Saturn	11.3	
13	37-W	08 Apr	Rings in planets	11.4	
	38-F	10 Apr	Review for Midterm Exam #3	8,9,10,11	HW#10 due (Ch 10,11)
	39-M	13 Apr	NO CLASS	--	
14	40-W	15 Apr	Midterm exam #3	8,9,10,11	
	41-F	17 Apr	Dwarf planets, asteroids	12.1, 12.2	HW#11 assigned (Ch 12)
	42-M	20 Apr	Comets, meteorites	12.3, 12.4	
15	43-W	22 Apr	Our star – the Sun	14.1, 14.2	
	44-F	24 Apr	Solar atmosphere	14.3	HW#11 due (Ch 12) HW#12 assigned (Ch 14,24)

	45-M	27 Apr	Solar activity	14.4	
16	46-W	29 Apr	Life in the Cosmos	24	
	47-F	01 May	Review for final exam	All covered	
	48-M	04 May	Review for final exam	All covered	HW#12 due (Ch 14,24) Last day of classes!
17	49-W	06 May	INDIVIDUAL STUDY DAY NO CLASS	--	
	50-R	07 May 1:30-4:00pm	Final exam	All covered	

DISTRIBUTION OF COURSE MATERIALS

All course materials students receive or to which students have online access are protected by copyright laws. Students may use course materials and make copies for their own use as needed, but unauthorized distribution and/or uploading of materials without the instructor's express permission is strictly prohibited. Students who engage in the unauthorized distribution of copyrighted materials may be held in violation of the University's Code of Conduct and/or liable under Federal and State laws.

ADDITIONAL STUDENT RESOURCES (available from <https://digital.wwnorton.com/astro6>)

Students are encouraged to take advantage of the following available resources:

➤ **Videogame: At Play in the Cosmos**

At Play in the Cosmos is an award-winning, first-of-its-kind learning video game designed to introduce students to fundamental astronomical concepts and objects. The video game costs \$1 with the purchase of the eBook, Smartwork5, and Student Site bundle, but it is also available standalone. The game app itself can be downloaded from the Digital Landing Page for the book <https://digital.wwnorton.com/astro6>.

➤ **Student Site**

- *Astronomy in Action Videos*: 23 videos, a mixture of live demos and mini-lectures, which can help the student prepare for class or review what the student has learned.
- *AstroTours*: 30 tablet-compatible animations, a number of which are interactive, which use art from the text to help the student visualize important physical and astronomical concepts.
- *Interactive Simulations*: allow the student to manipulate variables and see how physical systems work.
- *Flashcards*: Interactive Flashcards help test student's understanding of key terms in each chapter.

ACADEMIC INTEGRITY

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. "Scholastic dishonesty" includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment

for two courses without the prior permission of the instructor) or the attempt to commit such an act. The full policy is available at <http://www.depts.ttu.edu/opmanual/OP34.12.pdf>

If cheating, use of non-authorized material 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.

RELIGIOUS HOLY DAYS

1. "Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20.

2. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.

3. A student who is excused under section 2 may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily. The full policy is available at <http://www.depts.ttu.edu/opmanual/OP34.19.pdf>

DISABILITY SERVICES

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. The full policy is available at <http://www.depts.ttu.edu/opmanual/OP34.22.pdf>

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 <http://www.depts.ttu.edu/titleix>.

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, <http://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, <http://www.voiceofhopelubbock.org> (24-hour hotline that provides support for survivors of sexual violence)
- The Risk, Intervention, Safety and Education (RISE) Office, 806-742-2110, <http://www.depts.ttu.edu/rise> (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 and/or text message information at:

<https://appserv.itts.ttu.edu/EmergencyAlert/>