Ast 301 - Introduction to Astronomy - Fall 2014 - MWF12 - #48515

Instructor: Dr Derek Wills, Professor of Astronomy (RLM 13.136, 471-1392, oo7@astro.as.utexas.edu).

TA: Wenbin Lu, graduate student (RLM 16.312, 471-8275, wenbinlu@astro.as.utexas.edu).

Textbook: "Astronomy: A Beginner's Guide to the Universe", by Chaisson and McMillan (7th edition). You don't need to bring it to class every day unless you want to.

Office hours: Wenbin's office hours are Tues 3:30-5, Wed 3-4; mine are Tues and Thurs 1:00-2:30. If you can't come at these times, just ask us for another appointment.

Grades: There are four in-class tests and an optional comprehensive final, all of equal length - only the best four of these five are counted. The final exam is comprehensive, and you have 3 hours in which to do it. The final (and ONLY the final) is an open-notes exam, when you can bring your OWN written or typed lecture notes (no laptops, commercial notes, textbooks, review questions, pop quizzes or old tests...). There are also 10 pop quizzes throughout the semester, whose total points equal those from one test. See the "Syllabus" handout for grading details, plus-minus divisions etc.

Tests: This class is strongly lecture-based; study your notes when preparing for tests rather than just trying to memorize material from the book. Make-up tests will not be given since you can miss one test and still count the other four for your course grade. I will hold a review session the evening before each test; attendance is voluntary but strongly recommended. The in-class test dates are Sep 19, Oct 13, Nov 5 and Dec 5. The final exam is 2-5 pm on Dec 15 (the date and time are set by UT). Be warned that I do not tolerate dishonesty on tests - I report cases to the Dean of Students, and recommend an F for the course. Please bring a photo ID to tests.

Review questions: I will occasionally give out some review questions that you should treat like homework, although they will not be graded. Our TA will hold a help session for each set of questions before the answers are posted; again, attendance is voluntary but recommended, and to get the best value from these sessions you should try the review questions by yourself first. A list of relevant questions from the textbook is on the back of this sheet, and our Canvas website has about 450 representative questions from earlier tests that you can use to check your understanding of the course material.

Mathematics: This is a science course, and you will have to do some mathematics, mainly on the review questions. The tests are mostly non-numerical, and all the techniques you need will be covered in class. A review of the relevant math is on our Canvas website.

Class etiquette: (1) Please don't sit all the way at the back of the classroom if there is room closer to the front. I won't pick on people near the front to answer questions but I may pick on you if you are in the last few rows! (2) I encourage questions over

the material during class - if you are not understanding something, other people are probably having the same problem. (3) If you have a cell 'phone, I don't want to see it - ever! Laptops are OK but not if you are using them to surf the web!

General comments: Keep up with the material as we go through the course. The syllabus tells you the relevant parts of the textbook to read. Class attendance is crucial - IF YOU DON'T PLAN ON COMING TO MANY CLASSES, DROP THIS COURSE WHILE YOU STILL CAN!! You will be tested more on your understanding of the material than on pure memorization.

Disabilities: UT Austin can provide academic accommodations for qualified students with disabilities (Services for Students with Disabilities, 471-6259).

Star parties: Every Wednesday evening the 16-inch telescope on the RLM roof is open for viewing, and on Friday and Saturday nights the 9-inch one on Painter Hall is open; staff and TAs conduct these free events.

Astronomy Students Association: The ASA welcomes your (free) membership.

Some interesting web sites:

Astronomy Picture of the Day: http://antwrp.gsfc.nasa.gov/apod/astropix.html
International Space Station sightings: http://www.heavens-above.com/PassSummary.aspx?satid=25544&lat=30.2692&lng=-97.7436&loc=austin+tx&alt=0&tz=CST
Current view from the International Space Station: http://eol.jsc.nasa.gov/HDEV/
Iridium satellites - Austin predictions: http://www.heavens-above.com/iridiumflares.aspx?lat=30.2692&lng=-97.7436&alt=0&loc=Austin&TZ=CST&Dur=7
Iridium satellites (more info): http://www.satobs.org/iridium.html
EarthSky: http://earthsky.org/
StarDate: http://stardate.org/

I am required to include the following sentence: "This course may be used to fulfill three hours of the natural science and technology (Part I or Part II) component of the university core curriculum and 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."

Course syllabus - Ast 301

I will cover topics in the order listed below, even if it departs somewhat from the order in our textbook. The four tests will cover approximately Chapters 0-1, 2-4, 9-12 and 13-17, but don't take this too literally - it will depend on what topics have actually been covered in class, which might be slightly more or less than the above rough divisions. I cannot predict exactly which topics will be covered on which day, partly because pop quizzes use class time and their dates are unknown (of course). The relevant sections of the textbook are listed on the right, for each of the main topics.

Chapter 0: - powers of ten (App. 1)	
- metric system, scales and sizes, light travel time	
- angles (More Precisely 0-1, p 10), the skinny triangle	
- parallax and the parsec (also p 270), seeing (p 81)	
- motions of the earth: rotation (sidereal vs solar day), revolution (seasons), precession, the tropical year	0.2
- the moon: phases, sidereal vs synodic month, synchronous rotation and tides (also Section 5.2), solar and lunar eclipses, eclipse seasons	0.3
Chapter 1: - motions of the planets: retrograde motion	1.1
- Galileo's observations	1.2
- planetary configurations and visibility of inferior and superior planets (also p. 164), sidereal vs synodic periods	
- Kepler's laws	1.3
- mass and weight, Newton's laws and gravity. Your weight on e.g. the moon, falling objects. Newton's modifications of Kepler's laws. Predictions of Newton's laws, orbital and escape speeds, earth satellite orbits	1.4
Chapter 2: - properties of light: wavelength, frequency, photons (p 59)	2.1
- the EM spectrum, atmospheric windows	2.3
- black-body (thermal) radiation (Planck, Wien, Stefan), stars' luminosities and apparent brightness (pp 272-273)	2.4
- spectral lines (absorption, emission), the sun's spectrum	2.5
- atoms, the spectrum of hydrogen (orbits vs excited states)	2.6
- the Doppler effect	2.7
Chapter 3: - telescopes (refracting, reflecting), chromatic and spherical aberration, the Hubble Space Telescope (pp 74-75)	3.1
- light-gathering power, surface accuracy, angular resolution	3.2
- seeing, adaptive optics, new telescopes, CCDs (3.1)	3.3
- radio telescopes and interferometers	3.4
- astronomy at other wavelengths	3.5

Chapter 4: - solar system planets (terrestrial, Jovian)	4.1
- searches for other planetary systems	4.4
Chapter 10: - stars' distances, proper motion	10.1
- stars' luminosities and apparent brightness	10.2
- stars' temperatures and spectral classes	10.3
- stars' sizes	10.4
- the H-R diagram; red giants and white dwarfs	10.5
- spectroscopic parallax	10.6
- stars' masses and radii (binary stars - visual, spectroscopic and eclipsing), the mass-luminosity relation, stars' main-sequence lifetimes	10.7
Chapter 9: - nuclear fusion in the sun, proton-proton chain, solar neutrinos	9.5
- energy transport in stars, the solar model	9.2
Chapter 11: - dust and gas in our galaxy	11.1
- 21 cm radiation	11.3
- formation of main-sequence stars via protostars	11.4
- brown dwarfs	11.5
- star clusters	11.6
Chapter 12: - post-main-sequence evolution, red giants	12.2
- death of sun-like stars, white dwarfs	12.3
- evolution of high-mass stars	12.4
- supernovae (Types I and II)	12.5
- star clusters as a check on stellar evolution theories	12.6
Chapter 13: - after the supernova: formation of neutron stars	13.1
- discovery of neutron stars as pulsars, the Crab Nebula, synchrotron radiation (pp 427-428)	13.2
- black holes: escape speed, the event horizon and singularity	13.5
- falling into a black hole	13.7
- detection of black holes in our galaxy, Cygnus X-1	13.8
- (more massive black holes - 14.7, 15.5)	
Chapter 14: - our Milky Way galaxy	14.1
- size and shape of our galaxy	14.2
- stellar populations	14.3
- rotation curve and mass of our galaxy, dark matter	14.6
Chapter 15: - other galaxies (spirals, ellipticals, irregulars)	15.1
- galaxy clusters and distribution (also 16.5), galaxy distances	15.2
- galaxy redshifts, Hubble's law	15.3
Chapter 17: - Olbers's paradox, the expanding universe and its age	17.2

- critical density and the fate of the Universe - open/closed?	
(dark matter in the Universe, 16.1), accelerating?	17.3, 17.4
- the cosmic microwave background radiation	17.5
- the horizon and flatness problems, cosmic inflation	17.7