Astronomy PHYSICS 109 Spring 2019

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web: http://users.wfu.edu/ecarlson **Cell Phone:** 336-407-6528
Class location: Olin 101 **Lab location:** Olin 105
Class times: MWF 12:00 – 12:50 lecture, plus two hour lab 8-10 PM based on section
Class web: http://users.wfu.edu/ecarlson/astro

Materials: ***The Essential Cosmic Perspective*, *8th edition*** by Jeffrey Bennett *et al.*, with *Mastering Astronomy*; Laptop computer; *Stellariam* software; *TopHat* software; calculator.

Adding/Changing Sections: If you are not registered for this course and want to be, or wish to change lab sections, this can only be done via WIN through about January 18. After that I will invite students to join or switch based on a list that I am creating. To get on this list, sign up at

https://goo.gl/forms/4RoqPOGNirJgneaX2

Description: Physics 109 is an intensive introductory course in astronomy. Topics covered will include the night sky, the solar system, stars and stellar systems, galaxies and the universe as a whole. Elementary physics and mathematics will be used to obtain both a qualitative and a quantitative understanding of astronomy.

Tests: There will be three in-class tests during the semester on **Feburary 6, March 6,** and **April 5** in class. The final exam will be at **2:00 Friday May 3. None of these grades will be dropped**. Half of the questions on the final will cover the final quarter of the course; the other half will be a review of the entire course. Alternate times will normally not be allowed for the final or any other exam. Exams which are missed can only be made up if **proof** is provided of illness or family or other emergency. To every test, you must bring **your student ID, #2 pencil, and a calculator**.

Cheating: Any evidence of cheating will be turned over to the honor board for consideration. The normal consequence for an honors code violation is an irreplaceable F in the course and a one semester suspension from all courses.

Homework: There will be a homework set due at 11:50 PM every Sunday. Late submissions are not accepted, unless you are specifically granted an extension by me. Each homework set will consist of a reading quiz for each day of lecture that week (each of which is about 4 multiple choice questions), and a few tutorials explaining some of the important concepts covered in class that week. These homework sets can be found at

https://www.pearsonmylabandmastering.com/northamerica/

Once there, you can sign up for temporary access, or if you have already paid, you can get permanent access using a code that you purchase. You then need to sign up for **carlson78119**, which is the name of the course. You will need to enter your eight-digit student ID number, which is on your student ID card.

You are expected to work on these problems by yourself. You may ask your friends, TA's, or others for help, but they should not do the problem for you, you should do the problem yourself. **Copying homework answers from another student is considered an honors code violation.**

Class Participation: You are expected to attend every lecture. You will be graded on in-class multiple choice questions which should not be too difficult. In order to do so, you will need to download the tophat participation software, which is available from the website

https://app.tophat.com/login/756981

The last part of this is the course access number, **756981**. You will need to download software onto your laptop or your phone (I recommend your phone) to participate in class. You can get this software for a free trial period, after which you will have to pay for it, though you can still get it reimbursed for a period of about two weeks. Make sure you purchase the software for a four month period.

The multiple choice questions will probably be graded as follows: Correct answers are worth 4 points, incorrect 1 point, and no response 0 points. Most questions should be easy enough that you can get them right. Your lowest eight class participation grades will be dropped, so this should be enough to make up for any conflicts, illnesses, etc. For ordinary classes, no note is required if you miss due to illness, etc.

Labs: Labs will be held from 8-10 PM every week in room **105 Olin Physical Laboratory** beginning **Sunday, January 20**. You are expected to attend and complete all twelve of the labs. Your lowest lab grade will be dropped. There will be some outdoor labs and you should dress **much more warmly** for them than you normally would to travel to and from class. **Be prepared on any given night to go outside.** You should bring to lab the following: pencil, eraser, lab description/sheets, calculator, laptop computer. In addition, you will need *Stellarium* software for lab. This software can be downloaded for free from

https://stellarium.org/

Lunar Eclipse Party: There will be an optional lunar eclipse lab/party on Sunday Jan. 20-Mon. Jan. 21 from 10:15 pm -12:15 am on the roof of Olin Hall (or in Olin 101). The entire class is invited. You may subsitute your grade for this lab for any other lab (essentially, your two lowest lab grades are dropped).

Lab manual: There is no lab manual for this course. Instead, you are expected to download all necessary labs from the web page as described below in the section "web." If you do not download it, you can purchase a copy from the TA on duty for $5. It is much cheaper to print it yourself.

Absences: If you miss a lab for any reason, email or call my office number immediately (that night). If you are too sick to call, I will need to see a note from the hospital (if you're not in the hospital, you're not too sick to call). Then I will write you a note, and you will find another section that is doing the same lab. The same procedure is required for tests. You do not need a note to miss class. **The only excused reasons for absence are illness, official WFU events that require attendance, or absences approved in advance by Dr. Carlson.** Never ask you TA for permission to make up a missed lab; he cannot grant it.

Contacting me: Please feel free to contact me by e-mail or make an office appointment whenever you want to. I am much more approachable than you might expect, and I am happy to help you prepare for the exams, or whatever. If you have a quick question, you can try me by e-mail.

World-Wide-Web: Lab schedules, lab descriptions, old tests, grades, and other important information for this course will be available from the class home page at

http://users.wfu.edu/ecarlson/astro

Grading: Your grade depends on your scores on the reading quiz, homework, exams, final, and labs in the proportions shown below. The grading scale is shown at right. I reserve the right to adjust this scale, but usually such adjustments are small, particularly at the high end of the grading scale. **However, if you receive a final lab grade that is less than 60%, you will fail the course.** It is easy to score well above 60% provided you attend all of your lab sections and work hard on the labs.

Grading Breakdown		Grading Scale		
Exams:	3 × 14%	94% A	80% B–	67% D+
Final:	28%	90% A–	77% C+	63% D
Homework:	15%	87% B+	73% C	60% D–
Labs:	10%	83% B	70% C–	<60% F
Class Part:	5%			

Pandemic Plans: In the case of catastrophic closedown of Wake Forest University, an attempt will be made to continue classes. Check the web for further information. If the web is down, email me, call me at my home number or try my cell phone. If you lose these numbers, get them from me in person, or from a friend.

Schedule

Section 1: The Motions of the Heavens		Reading Assignment
Mon. Jan. 14	Introduction; scale of the universe	Sections 1.1-1.3
Wed. Jan. 16	Motion of the Sun, Moon and stars	Sections 2.1-2.3
Fri. Jan. 18	Motion of planets, history	Sections 2.4, 3.1–3.3
Tue. Jan. 22	**Homework A**	
Wed. Jan. 23	Newton's laws, gravity and orbits	Sections 4.2-4.4
Fri. Jan. 25	Gravity, energy, waves	Gravity lecture
Sun. Jan. 27	**Homework B**	
Mon. Jan. 28	EM waves, Doppler shift	Section 5.1
Wed. Jan. 30	Atomic spectra, hot stuff	Section 5.2
Fri. Feb. 1	Telescopes	Section 5.3
Sun. Feb. 3	**Homework C**	
Mon. Feb. 4	Survey of Solar System	Sections 6.1
Wed. Feb. 6	**Exam 1, Chapter 1-5**	none

Section 2: The Solar System		
Fri. Feb. 8	Formation of Solar System	Sections 6.2-6.4
Sun. Feb. 10	**Homework D**	
Mon. Feb. 11	Earth	Sections 7.1, 7.5
Wed. Feb. 13	Moon, Mercury	Section 7.2
Fri. Feb. 15	Venus	Section 7.4
Sun. Feb. 17	**Homework E**	
Mon. Feb. 18	Mars	Section 7.3
Wed. Feb. 20	Jupiter, Saturn, Uranus and Neptune	Section 8.1

Fri. Feb. 22	Moons of Jupiter and Saturn	Section 8.2
Sun. Feb. 24	**Homework F**	
Mon. Feb. 25	Moons of Uranus and Neptune, rings	Section 8.3
Wed. Feb. 27	Dregs of the Solar System	Sections 9.2, 9.3
Fri. Mar. 1	Meteorites, extrasolar planets	Sections 9.1, 9.4, 10.1
Sun. Mar. 3	**Homework G**	
Mon. Mar. 4	The Sun – exterior	Sections 11.1, 11.3
Wed. Mar. 6	**Exam 2, Chapters 6-9**	none

Section 3: The Life History of Stars

Fri. Mar. 8	The Sun - interior	Section 11.2
Sun. Mar. 17	**Homework H**	
Mon. Mar. 18	Measuring stars, the H-R diagram	Sections 12.1, 12.2
Wed. Mar. 20	Low mass stars through main sequence	Section 13.1
Fri. Mar. 22	Late stages & death of low mass stars	Section 13.2
Sun. Mar. 24	**Homework I**	
Mon. Mar. 25	High mass stars	Section 13.3
Wed. Mar. 27	Supernovae, neutron stars, pulsars	Section 14.2
Fri. Mar. 29	Black holes, clusters	Sections 14.3, 12.3
Sun. Mar. 31	**Homework J**	
Mon. Apr. 1	Binary stars	Sections 14.1, 14.4
Wed. Apr. 3	The Milky Way galaxy	Sections 15.1, 15.2, 15.4
Fri. Apr. 5	**Exam 3, Chapters 10-14**	none
Sun. Apr. 7	**Homework K**	

Section 4: Galaxies and the Universe

Mon. Apr. 8	Dark matter, galaxy classification	Sections 18.2, 16.1
Wed. Apr. 10	Galaxy collisions, active galaxies	Sections 16.3, 16.4
Fri. Apr. 12	The cosmic distance ladder	Section 16.2
Sun. Apr. 14	**Homework L**	
Mon. Apr. 15	Hubble's law, large scale structure	Section 18.3
Wed. Apr. 17	Cosmology	Sections 18.1, 18.4
Sun. Apr. 21	**Homework M**	
Mon. Apr. 22	Cosmic eschatology, the big bang	Section 17.1, pp. 485-489
Wed. Apr. 24	The big bang	Sections 17.2, 17.3
Fri. Apr. 26	Multiple universes	Multiple Universe lecture
Sun. Apr. 28	**Homework N**	
Mon. Apr. 29	Intelligent life in the universe	Sections 19.3, 19.4
Wed. May 1	Review	none
Thu. May 2	**Homework O**	
Fri. May 3	**2:00 PM Final Exam**	