West Chester University

PHY 105-01: Structure of the Universe
Spring 2015

Course Overview: The ultimate goal of this course is for you to gain insight into how the science of physics can be applied to the study of planets, stars, galaxies, and the universe as a whole. We will begin our studies by examining our place in the universe, and how the motions of stars and other celestial bodies appear to us as observers on Earth. From there, we will study the modern physical theories of motion, light, and matter which help us make sense of the world we live in. The rest of the course applies these physical theories to the study of the universe and its contents. Here we shall see how our physical models are further tested and refined, and how experiments and observations can indicate a need for the creation of new physical theories. At appropriate times during our studies, we will discuss the history of our current physical model of the universe as well as the scientists who developed it. Throughout the course, we will develop and build analytical reasoning and problem solving skills which are widely applicable to our modern life.

Course Credit: This 3 credit course is an approved course in the WCU General Education program.

Course Requirements: This course has no prerequisites. However, we will be doing some basic algebra at the high school math level; I will assume that you have done this sort of math before, though it may be a few years since you've seen it or used it. We will also be reading and interpreting graphs, in addition to extending an existing body of knowledge to new situations in order to understand them. I will assume that you have some experience doing these things, but haven't practiced with them in a while.

Meeting Times: Tuesdays and Thursdays from 11 AM to 12:15 AM
Merion Science Center, room 113

Required Course Materials:

- *The Essential Cosmic Perspective, 6th Ed.*, by Bennett, Donahue, Schneider, and Voit.
- A stand-alone calculator which is ***not*** part of a cell phone or other internet-accessible personal electronic device.
- A Turning Technologies ResponseCard RF LCD clicker

Instructor Information:

Dr. Michelle A. Caler
office: 135 Merion Science Center
office hours: Mondays, Wednesdays, Thursdays, and Fridays from 2:00PM—3:00PM
Tuesdays from 2:00PM—4:00PM
… and by appointment
email: mcaler@wcupa.edu
office phone: 610-436-2320
webpage: This course has a D2L webpage. Homeworks, this syllabus, and all other related course materials will be posted to this webpage. Please let me know if you are unable to access it. Being able to access the D2L website will be critical to student success in this course.

Course Goals: The ultimate goal of this course is for you to gain insight into how the science of physics can be applied to the study of planets, stars, galaxies, and the universe as a whole. During the span of this semester, we will survey a wide variety of objects and phenomena in the universe, from the very smallest scales to the largest in the cosmos. While I hope you will gain an appreciation of these celestial bodies for the beautiful things that they are, our larger goal in studying them is to illustrate how the methods and ideas of science inform our understanding of phenomena that we observe in our universe, as well as the universe itself. In addition, we will engage in a historical consideration of the development of modern theories of the physical world, to help you see how the methods of science have worked to produce the ideas we use today.

More specific course goals for PHY 105 include:

- gain an understanding of and appreciation for the nature of science
- understand how the scientific method can be applied to astronomy
- develop a basic understanding of how ideas from the science of physics are applied to the study of astronomical objects in order to explain their origins and characteristics
- know several different ways to represent the information contained in quantitative word problems, and use those representations to successfully arrive at a solution

Cooperative in-class activities such as "Voting Opportunities," discussion questions, and practice problems (as detailed on page 5 of this syllabus), as well as assigned homework problems, will contribute to students' achievement of the above Course Goals.

As we work to achieve our course goals, I will be emphasizing the ability to reason with and work with concepts and equations rather than lots of strict fact memorization or complicated mathematics. (We will need to memorize some things, though.) In doing so, we will learn analytical thinking skills, how to make connections between concepts, and how to communicate your reasoning to others. We will also be making quantitative predictions about phenomena, which *does* require some basic mathematical ideas. These ideas include, but are not limited to, simple algebra, proportionality, scaling, and working with powers of 10. **DO NOT PANIC** if it's been awhile since you've seen these mathematical terms! We will develop them as we go through the course.

Course General Education Goals: PHY 105 is an approved course in the WCU General Education program. As such, it is designed to help students meet the following general education goals:

Goal #2: Employ quantitative concepts and mathematical methods

This goal will be accomplished through in-class "Voting Opportunity" activities (as detailed on page 5 of this syllabus), example and practice problems discussed in lecture, and assigned homework problems.

Goal #3 Think critically and analytically

This goal will be accomplished through in-class activities such as "Voting Opportunities" and discussion questions (as detailed on page 5 of this syllabus), as well as assigned homework problems.

Grading: Class participation: 15%
Homework: 20%
Exams: 45%
Cumulative Final Exam: 20%

Class Participation and Attendance: Class participation will be recorded using the Turning Technologies ResponseCard RF LCD clicker system. I am ***requiring*** that you buy a ResponseCard RF LCD and register it. Please purchase and register your ResponseCard by **Thursday January 29th at 10AM**. Make sure that you bring it to every class, and that you occasionally check its battery life. I will have **ONE** spare ResponseCard that you can borrow in case you forget yours: first come, first served. You get **two** borrows per semester, and you must return my ResponseCard when class is over. If my spare ResponseCard walks away, there will be **NO** emergency borrowing opportunities for *anyone* for the rest of the semester.

Each day of class (test days not included) will be worth 5 points of class participation credit. Class participation points will be earned by responding with your ResponseCard to questions that I ask during my

PowerPoint presentations. These questions will consist of (but are not necessarily limited to) "Voting Opportunities" and "YouPredict Opportunities." I reserve the right to introduce ways in addition to these to earn class participation credit. To earn full class participation credit for a class period, you need to respond using your ResponseCard to ***ALL*** response questions asked in class, even times when I ask you to respond again after talking to a neighbour. Partial class participation credit will be awarded only under special circumstances, and at my discretion. You ***DO NOT*** have to answer response questions *correctly* in order to get full credit: you just have to attempt them. It is in your best interest to do your best to get the correct answer, though, so don't just randomly hit buttons when the questions come up. Give them your best go.

You ***MUST*** be present in class responding with your ResponseCard in order to receive class participation credit. Thus, I am expecting you to attend all scheduled classes for the entire scheduled time. I do understand that on occasion something unforeseen will pop up and prevent you from attending class; therefore, at the end of the term I will drop three days of class participation points. Any additional unexcused absences will result in ZERO class participation points for those dates. If you miss class due to an excused absence, it is ***IT IS YOUR RESPONSIBILITY*** to contact me by email to arrange a way to make up the class participation points that you missed. Excused absences are limited to University-Sanctioned Events (which follow the Excused Absence Policy for University-Sanctioned Events as described in the West Chester University Undergraduate Catalog), and absences due to serious illness or injury, or the death of family members (each of which is to be verified in writing by a practicing, non-related physician). In cases of extreme illness or emergency that will require prolonged absence, *you are responsible* for contacting Dean Bricketto (Student Affairs). His office will contact your professors and make appropriate recommendations. If you are absent, whether excused or unexcused, ***IT IS YOUR RESPONSIBILITY*** to get the notes you missed from a classmate—**including** notes on any quantitative problems worked in class—and to learn of any important announcements that were made.

In order to earn class participation points with your ResponseCard, ***YOU*** must be the one entering responses with it. I have a zero tolerance policy for ANYONE who hands their ResponseCard to a classmate and tells that classmate to use it in class for them. If I catch ***ANYONE*** using multiple ResponseCards in a class, this will be construed as cheating, and ***ALL*** involved parties will lose ***ALL*** class participation points for the semester. I reserve the right to introduce alternate forms of attendance taking to enforce this policy.

As with any technology, problems with the ResponseCard system can pop up unexpectedly. Thus, in the event that unforeseen circumstances arise, I reserve the right to change details about how class participation credit is awarded on a particular day as circumstances warrant it. You will be notified of any such changes both in class and on D2L. I also reserve the right to increase the number of dropped days of class participation due to unforeseen circumstances.

Homework: All homework will be posted and submitted online through the "homework" section of this course's D2L webpage. There will be nine homeworks assigned over the course of this semester. ***YOU ARE RESPONSIBLE FOR CHECKING D2L AND KEEPING UP WITH HOMEWORKS***; this means checking to see that an assignment has been posted, knowing when it is due, and ensuring that it is completed before the deadline. To help you with this, I have included a column in the class schedule at the end of this syllabus that tells you **WEEK BY WEEK** what homeworks will be posted, when they will be posted (date/time), and when they will be due (date/time). If the course schedule is adjusted from what appears at the end of this document, it will be posted to D2L and there will be an announcement made in class. Life can get very busy during a semester, so it can be hard to remember to log in to do homeworks even when you know when they are being posted. Thus, you may wish to set up pre-timed reminders to check in on our course's D2L site. **I will not always remind you in class about homeworks**! It is ***YOUR RESPONSIBILITY*** to remember to do them.

You may re-do a homework as often as you like before it is due; I will keep only your highest score for my gradebook. But regardless of how many times you attempt one, **homeworks are due on the due date and time indicated on the class schedule and D2L**. No late homeworks will be accepted, ***no exceptions***. This is because homework solutions will be posted shortly after the homework's due time. At the end of the semester, I will drop your lowest homework grade. This way, it's not a big deal if you miss one assignment. But if not doing homework becomes a habit, your grade **will** suffer quite a bit come the end of the semester.

If you have a question or a computer problem, you must notify me at least 24 hours before the homework due date. Plan on your internet access and/or computer failing at the *worst possible time*, so ***have a go at the homework at some point before the day it is due***. Report any problems with D2L ASAP by calling 1-877-325-7778 or visiting the ACC help desk in Anderson 20 (610-436-3350).

I encourage you to discuss the homework problems with each other, but ***the work you do on homeworks must be your own.*** (See the Academic Integrity statement on page 6 of this syllabus.) I also encourage you to discuss and review course material with your classmates. But be sure to study and think about the material on your own, because your classmates cannot help you on exams.

As with any technology, problems with D2L online assessments can pop up unexpectedly, and for this reason I reserve the right to change details about how they are conducted. I also reserve the right to modify homework due dates and times due to unforeseen circumstances. You will be notified of any such changes both in class and on D2L.

Exams: There will be four in-class exams given over the course of the semester. The dates of these exams are:

February 5
March 3
March 26
April 21

The range of chapters each exam covers is given in the course schedule, which can be found at the end of this syllabus. If the course schedule is adjusted from what appears at the end of this document, it will be posted to D2L and there will be an announcement made in class. Make sure to check D2L regularly to ensure that you have an up-to-date class schedule. ***You*** will be responsible for knowing what chapters will be covered on an exam, and when it is.

YOUR LOWEST EXAM GRADE WILL BE DROPPED. Thus only your 3 highest test grades will be counted. ***THERE WILL BE NO MAKE-UP EXAMS GIVEN***. You **CANNOT** take an exam early or late. If you miss an exam, you will receive a zero for it, and it will be used as your dropped exam. Exceptions will be made ONLY for absences due to University-Sanctioned Events as described in the West Chester University Undergraduate Catalog. If you have ANY questions or concerns about this particular point, please come talk to me and get clarification BEFORE it is too late!

Tests will consist of approximately 30—45 multiple choice questions and 1 open-ended problem, which I will design to be similar to example and practice problems done in class. A constant curve will be applied to an exam if the class average drops below 75% to increase it to this value. The scope of each test (with the exception of the final) is limited to the chapters listed in the class schedule at the end of this syllabus; however, even though earlier material is not explicitly tested it may still appear on an exam. You have been warned!

Tests will be *closed book* and *closed notebook*. However, I will give you one sheet of equations to use during the exam. This equations sheet will be **the only aid** allowed to you during exams, with the exception of a stand-alone calculator (as described below). All other written and electronic aids are **strictly forbidden**. I will post to D2L the equations sheet that I will give you for an exam at least 24 hours before the exam time, so that you can see what will be on the sheet. You are permitted to use a stand-alone calculator (i.e., one that is ***not*** part of an iPod/iPad, cell phone, tablet PC, Kindle, etc.) during exams. If I catch you using an internet-accessible personal electronic device as a calculator during an exam, I will take your exam and you will get a zero on it. No exceptions. If you will be using a graphing calculator, I must personally see you clear its memory before you receive your exam. I will NOT bring extra calculators for you to use during exams. It is ***YOUR RESPONSIBILITY*** to make sure you have a working stand-alone calculator for exams.

After each exam, I will return to you the answer sheet which contains your solution to the open-ended question, as well as the sheet which contains your responses to the multiple choice questions. I will write your exam grade at the top of the multiple choice answer sheet. I will hold the copies of the multiple choice exam questions in my office after you have seen them; you can make an appointment any time you like to come look at the multiple choice exam questions.

Final Exam: The final exam for this course will be given on Thursday, May 7th from 10:30AM—12:30PM. This is the time scheduled by the University registrar for our final exam. The final ***will be cumulative***, and ***it is mandatory.*** It will consist of approximately 40—60 multiple choice questions and 1 open-ended question. Missing the final exam will result in a zero for the exam unless EXTREME circumstances apply. Your final exam grade ***cannot*** be counted as your dropped exam score.

Extra Credit: I am offering ***one*** extra credit opportunity this semester. It is entirely optional; you are not required to do it. It will involve the semester-long observation of a single astronomical object that is **NOT** Polaris. Details of the project will be provided during the first class period. If you want to do the extra credit project, you MUST submit an observing plan to me by email by January 29th at 5PM. No plans will be accepted after this date. Projects will be due on April 30th at the start of class. Successful completion of this extra credit project will boost your overall course grade by one percentage point.

Teaching Style: I will be using MS PowerPoint slides a great deal when going over course material in class; occasionally, I will make use of the white board to work through a problem. I will try to write big enough so that everyone can see, but if you do have trouble seeing what I write please move to the front of the room. Before each class, I will post to our course's D2L webpage **modified copies** of the MS PowerPoint slides I will use in class, in the so-called "structured note-taking" style. The slides I put up on D2L are **NOT** meant to take the place of your own personal note-taking. ***YOU*** will be responsible for that. I provide these modified slide copies to give you the text for in-class activities we will do, so that you do not need to worry about copying down their text and can instead concentrate on thinking about them. I will also leave plenty of room for you to write down key equations, words, and other ideas so that you'll remember them later. Please note carefully that these modified slides will NOT contain solutions to example problems done in class, nor will they contain each and every word seen on the in-class slides. If you want notes on these things, you'll need to take them for yourself as we go through the material in class.
I will do my best to engage you interactively with the material during class time. Activities may include, but are not limited to, conceptual questions to be discussed with a neighbour, tutorial activities, "Voting Opportunities," "YouPredict Opportunities," practice quantitative problems, and interactive demonstrations. I hope these activities both enhance your learning and help make class a little more exciting for you. Also, these cooperative in-class activities, in addition to assigned homeworks and exams, are designed to contribute to your achievement of the general education goals and course goals that this class has been designed to meet.

Intellectual Property Statement: The instructor for this course utilizes copyrighted materials under the "Freedom and Innovation Revitalizing United States Entrepreneurship Act of 2007" (Fair Use Act). Apart from such copyrighted materials, all other intellectual property associated with this course is owned and copyright protected by the instructor, including, but not limited to, lectures, course discussions, course notes and supplementary materials posted or provided to students authored by the instructor, assessment instruments such as quizzes and exams, and Power Point presentations. No recording, copying, storage in a retrieval system, or dissemination in any form, whether electronic or other format, by any means of the intellectual property of the instructor, either in whole or in part, is permitted without the prior written permission of the instructor. When such permission is granted, it must specify the utilization of the intellectual property and all such permissions and waivers shall terminate on the last day of finals in the semester in which this course is held.
Links and references to on-line resources provided by the instructor may lead to other sites. The instructor does not sponsor, endorse or otherwise approve of any information appearing in those sites, nor is responsible for the availability of, or the content located on or through, external sites. Apart from materials used in accordance with the Fair Use Act, the instructor takes no responsibility for material that is otherwise offered at web sites and makes no warranty that such material does not infringe any third party rights. However, should any of this type of material be present and this fact is brought to the attention of the instructor, they will remove references to it from course materials.

Ye Olde Technology Policy: Please turn off all cell phones, iPods/iPads/iPhones, tablet PCs, Kindles, laptops, etc. before class. If you are expecting an emergency call, change your phone to vibrate mode and answer the call outside of our classroom. You are ***not allowed*** to use cell phones for texting or gaming during class. Doing so is distracting to your classmates and instructor. If I catch you using a personal electronic device inappropriately during class, ***I will take 5 points off of the nearest exam grade***! **NO EXCEPTIONS**. If you feel the temptation will be too great, be on the safe side and leave your device stored in your bag.

I do not allow the use of laptops or tablet PCs in my class. However, I am willing to make an exception for those who bought an e-copy of the textbook, provided that I see proof of the e-copy on your computer or tablet. I do understand that use of a laptop, or other personal electronic devices, may be required to accommodate certain disabilities. Terms of use in both of these cases can be discussed with me on an individual basis.

Email Policy: It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

Academic Integrity: It is the responsibility of each student to adhere to the University's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in automatic failure and removal from this course.

For questions regarding Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department's handbook, the Undergraduate Course Catalogue, the Rams Eye View, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

Disability and Special Needs: If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities(OSSD), please contact the OSSD which is located at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday 8:30 a.m. – 4:30 p.m. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at www.wcupa.edu/ussss/ossd.

Tutoring: Tutoring for many 100 level courses is offered by the Learning Assistance Resource Center (LARC), 223 Lawrence Center, x2535. As of the current moment, PHY 105 is not one of those courses; however, the folks at LARC will work with you to try and find a tutor if you need one. See the following website for more information: http://www.wcupa.edu/ussss/larc/. LARC tutoring is free of charge, but you must sign up at the beginning of the semester. Physics majors MAY offer tutoring in PHY 105 during the semester. An announcement will be made in class if this is the case.

Withdrawal Notice: A syllabus constitutes a contract between student and instructor. Your continued enrollment after the **January 27th drop deadline** indicates that you accept all instructional practices, requirements, and policies. If you find the standards to which you will be held accountable too rigorous, if you are unable to *reliably* access the internet to log on to D2L, or if an ongoing scheduling conflict prevents you from attending class regularly and punctually, you must officially withdraw (grade "W") through the Registrar's Office by the **March 27th course withdrawal deadline**. You are responsible for checking your grades before this withdrawal deadline so you aren't surprised by your standing as the end of the course approaches. You can contact me anytime to get an estimate of your grade as it stands at the moment.

Public Safety: All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information and to sign up, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

Study tips:

- Look at the learning objectives to see what I expect you to know and know how to do by the end of each unit and each chapter. All in-class exams will be based on the chapter learning objectives; the final exam will be based on the unit learning objectives. Learning objectives for all units and chapters will be posted to the "course materials" section of D2L.
- Keep up with the readings and do them before class!
- Don't blow off the homework! It's a good way to accumulate points, and good practice for exams.
- Practice makes perfect! Before an exam, pick some of the problems from the end of the chapter questions and do them. Play "what-if" games with the equations concepts presented in class: What if I gave you two quantities and asked for a third? What's your plan for that? What would happen if the Solar Nebula had had an initial clockwise rotation instead of a counterclockwise one … what would we expect the orbits of the planets to be like? If you have an action plan for these things in your head, you're less likely to freeze up and panic if you see them on a test.
- Please make use of my office hours, and don't hesitate to email me questions about the homework or to schedule a time to meet outside office hours.

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CLASS SCHEDULE

This is the tentative schedule; I will try to follow it as closely as possible. I will post any changes to this schedule to D2L, and announce in class that an updated schedule has been posted. ***IT IS YOUR RESPONSIBILITY*** to make sure that you have an up-to-date class schedule.
It is also ***your responsibility*** to read the assigned selections from the text before you arrive in class. I will not always cover in class everything that is contained in the readings.

Week	Homework	Class Meeting	Topic	Readings Due
1	HW #1 posted on D2L at 8AM on January 20	January 20	Welcome, Course Intro, Meet the Universe	--
		January 22	Scales of stuff in the universe	Ch. 1
2	HW#1 DUE on January 28 at 10PM	January 27	Finding your way in the night sky + seasons	Ch. 2.1—2.2
	HW #2 posted on D2L at 8AM on January 28	January 29	Wanderers: the Moon and the Planets	Ch. 2.3—2.4
3	HW#2 DUE on February 4 at 10PM	February 3	Ancient Astronomy and the Copernican Revolution	Ch. 3
		February 5	***TEST #1***	***Chapters 1—3***
4	HW #3 posted on D2L at 8AM on February 10	February 10	Newton's Laws of Motion	Ch. 4.1—4.2
		February 12	Angular Momentum and Energy	4.3
5	HW #4 posted on D2L at 8AM on February 19	February 17	Gravity: Nature's most attractive law	Ch. 4.4
	HW#3 DUE on February 20 at 10PM	February 19	Light and Matter: What really matters	Ch. 5.1
6		February 24	Light gets excited	Ch. 5.2
		February 26	Telescopes: Giant "Eyes" on the Sky	5.3
7	HW#4 DUE on March 2 at 10PM	***March 3***	***TEST #2***	***Chapters 4 & 5***
	HW #5 posted on D2L at 8AM on March 5	March 5	The Origin & Making of the Solar System	Ch. 6.1—6.3
		March 10	*Spring break!*	

		March 12	*Spring break!*	
8	HW #6 posted on D2L at 8AM on March 18	March 17	Star Systems: Others, and Our Own	Ch. 6.5—6.2
	HW#5 DUE on March 19 at 10PM	March 19	Earth and its Rocky Neighbours	Ch. 7.1—7.4
9	HW#6 DUE on March 25 at 10PM	March 24	The Outer Solar System	Ch. 8.1, 8.2, 9.1
		March 26	***TEST #3***	***Chapters 6—9***
10	HW #7 posted on D2L at 8AM on March 31	March 31	Your local star: Sol	Ch. 10.1—10.2
		April 2	Star Properties + The Main Sequence	Ch. 11.1
11	HW #8 posted on D2L at 8AM on April 9	April 7	Star Clusters and the Main Sequence	Ch. 11.2—11.3
	HW#7 DUE on April 10 at 10PM	April 9	Star Clusters and Star Births	Ch. 11.3 and Ch.12.1
12		April 14	Low Mass Star, This is Your Life!	Ch. 12.2 and Ch.13.1
		April 16	High Mass Star, This is Your Life!	Ch. 12.3 and Ch.13.2—13.3
13	HW#8 DUE on April 20 at 10PM	***April 21***	***TEST #4***	***Chapters 10—13***
	HW #9 posted on D2L at 8AM on April 23	April 23	Galaxies: It's a zoo out there!	Ch. 15.1—15.3
14		April 28	The Dark Side: Dark Matter and Dark Energy	Ch. 16.1, 16.2, 16.4
	HW#9 DUE on May 4 at 10PM	April 30	A brief history of the universe + the Big Bang	Ch. 17.1—17.3
15		***May 7***	***FINAL EXAM***	***10:30 AM—12:30 PM***