

PHY 100-01: DESTINATION: ALPHA CENTAURI

WEST CHESTER UNIVERSITY – FALL 2016

COURSE SYLLABUS

UPDATED: August 24, 2016

INSTRUCTOR

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SECTION DETAILS

Section: 100-01

Time: MWF 10:00-10:50 am

Location: Merion 109

Office hrs: MWF 3:00–4:45 pm

Final exam: W 12/14, 10:30–12:30 pm

COURSE DESCRIPTION

This section of *PHY100: Elements of Physical Science* provides an introduction to the physics of interstellar travel. The first part of the course covers topics in mechanics including kinematics, Newtonian dynamics, work & energy, and momentum. The second part of the course introduces topics relevant for the interstellar explorer, including celestial mechanics, cosmology, exoplanets, special relativity, and nuclear physics. As an introduction to the physical sciences, this course emphasizes science literacy and incorporates discussion of the scientific method, threats to learning science, and the representation of science in film, literature, and the media.

This course has no laboratory component; however, students will contribute to ongoing research efforts by participating in a citizen science project.

PREREQUISITES

This course uses pre-calculus mathematics, including algebra, trigonometry, and basic Euclidean geometry. No previous experience with physics or astronomy is required.

STUDENT LEARNING OUTCOMES

This course (PHY100) is an approved general education course in the Sciences (see the [WCU Undergraduate Catalog](#)) and as such meets the following general education goals:

- General Education Goal #2: Ability to employ quantitative concepts and mathematical methods. (Secondary Goal of Science General Education Courses)
- General Education Goal #3: Ability to think critically and analytically. (Primary Goal of Science General Education Courses)

More specifically, after successfully completing this course a student will be able to:

1. **Mathematically describe** mechanical and relativistic systems using the language of kinematics.
2. **Recognize physical concepts** at work in physical systems, including Newtonian forces, work, energy, momentum, and relativity.
3. Combine these elements to **analyze and solve** multi-part problems as well as make **quantitative predictions** for physical experiments.

These goals will be met through the following exercises:

- Class presentation and textbook reading will introduce the tools of mathematical description as well as the concepts employed in physical analysis.
- Collaborative in-class exercises and homework assignments will develop and practice analysis and problem-solving strategies in a low-risk setting.

This course also works to develop life-long **science literacy** through the following practices:

- Readings and class presentation will discuss the scientific method, how to distinguish science from pseudo-science, and the challenges to learning (and disseminating) science.
- Students will read approximately three academic journal articles on topics in physics, astronomy, and physics education.
- Through the casual environment of a course blog students will explore the relationship between science and society as seen in depictions of science in news, film, and fiction.
- Students will contribute to ongoing research in physics and astronomy by participating in a citizen science project.

OUTLINE OF CONTENT

This course is organized into six thematic units. Each unit will last approximately 2 weeks and will conclude with an exam or project. In addition, classes dedicated to enhancing science literacy are interspersed throughout the term.

1. *Getting off the ground*

Vectors, kinematics, free fall, projectiles, relative motion.

2. *How things move in space*

Newton's laws, gravity, normal and drag forces, uniform circular motion, orbits.

3. *The journey*

Introductions to light, cosmology, and exoplanets.

4. *Tricks of the trade*

Energy, work, linear momentum, conservation laws, collisions, rockets and spaceships.

5. *We need to travel fast*

Special relativity: the speed of light, time dilation/length contraction, spacetime, simultaneity and paradoxes.

6. *How to travel fast*

Nuclear physics: atoms and nuclei, stability and decays, fission and fusion, bombs and reactors.

COURSE STRUCTURE

- **CLASS:** Class time will be interactive and involve several types of activities. Most of our time will be filled with short lectures combined with problem-solving exercises designed to emphasize concepts and point out common pitfalls, get feedback from students, and encourage peer instruction. We will also have occasional demonstrations and group discussions. Attendance is mandatory.
- **PROBLEM SETS:** For each lecture topic I will provide *recommended* homework problems and their solutions. These problems are intended to be open, collaborative exercises – you may consult any people and references you like. I am happy to discuss any homework problem in class and during office hours. I will not collect or in any way assess these recommended problems.
- **EXAMS:** In-class exams are the primary method of assessing your conceptual and quantitative understanding of the material. During an exam you may use any written materials you bring with you as well as a stand-alone calculator (see page 4). Exams,

like all aspects of the course, are “cumulative”; however, each exam is focused on a set of material listed on the course schedule. For each exam I will provide a practice exam (with solutions) at least a week in advance.

- **READINGS:** On a few occasions I will assign a short supplemental reading. We will discuss these readings in class, so you should complete the reading prior to the class listed on the course schedule. Do the readings – I may quiz you.

I do not require you to read the textbook in advance of the class presentation.

- **WRITINGS:** On a few occasions I will ask you to perform a very brief writing assignment. These assignments will only take about 15 minutes each and may be written in a casual style.
- **CITIZEN SCIENCE PROJECT:** The third course unit, *The journey*, will not have an exam. Instead, students will contribute to on-going research in astronomy and astrophysics by participating in a [Zooniverse](#) citizen science project.
- **BLOG:** The course blog is a casual environment in which to interact with your peers and discuss broad connections between the science discussed in class and society (e.g., 20th century history, the presidential election, comic books). Students are expected to read the blog, add comments, and contribute posts.

COURSE MATERIALS

- **TEXTBOOK:** The course textbook is

Physics: A Conceptual World View, 7th Ed.

by Kirkpatrick and Francis

ISBNs: 0495391522, 9780495391524



You are welcome to use a previous edition of the text; however, when I recommend problems from the text I will refer to the latest edition. Available at the [WCU campus store](#), though I recommend you check online sellers for the best price.

- **CALCULATOR:** For exams you will need an stand-alone calculator with no internet or communication capabilities. You will want a calculator that can compute exponentials, powers, and operate in scientific notation. You may not use your mobile phone.

COURSE WEBSITES

- **D2L:** The course [D2L](#) site will contain all course materials, including an up-to-date syllabus and schedule, my lecture and class activity notes, recommended problems, supplementary readings, and practice exams. You will use this site to submit writing assignments and your project summary. I will use the [D2L](#) grade-book feature to post your homework and exam scores.

- PUBLIC SITE: I will maintain a public site containing most course materials at:

ramwebs.wcupa.edu/imorrison/PHY100/PHY100.html

- COURSE BLOG: The course blog is located at:

<https://alphacentaurifall2016.wordpress.com>

The blog will go live on Monday, Sept. 12. The blog is public, though students may post anonymously. All entries and comments must be approved by the instructor before they will be posted. Technical details about the blog will be discussed on Monday, Sept. 12.

STUDENT RESPONSIBILITIES

Achieving in academics requires planning, active participation in class, and careful studying outside class. As students in this course you are responsible for the following.

When planning:

- EMAIL: Regularly access, read, and respond to course communications sent to your university email account. I will only correspond via university email (mine and yours). Please include your course number in the subject of your correspondence.
- COURSE PLATFORM: Regularly check the course [D2L](#) site. I may not announce in class changes to course content on [D2L](#). As with all technology, online resources can have glitches and unscheduled service outages. For this reason, check [D2L](#) frequently and do not leave homework assignments to the last minute.
- ATTENDANCE: Attend class prepared to be an active learner.
- COURSE BLOG: Stay up-to-date on the course blog, and make sure to complete your contributions on schedule.
- UNIVERSITY-SANCTIONED EVENTS: If you will not be able to perform an aspect of the course due to a University-Sanctioned Event you must notify me in advance so that we can make arrangements. You must also provide official documentation verifying your participation in the event.
- ACCOMMODATION: If you require additional accommodation for any aspect of the course you must notify me in advance so that we can make arrangements. Depending on the accommodation, you may need to provide a letter from the [Office of Services for Students with Disabilities](#) (OSSD).
- FINAL EXAM PERIOD: The final exam time and date are arranged the by the Registrar's Office and can change. You should plan to be available the entire Final Exam Period (December 13-17, 2016).

When studying:

- **TEXTBOOK READING:** Read the sections of the textbook indicated in the course outline. You are not required to read the textbook before class, but you should read the textbook in tandem with the in-class presentation. It is up to you to determine how best to incorporate reading into your studying.
- **OFFICE HOURS:** If you are struggling with any aspect of the course, or if you wish to know more about a particular topic, please attend my office hours (which are listed on [page 1](#)).

ASSESSMENT

This course follows the official WCU scale for grades (see the [WCU Undergraduate Catalog](#)):

Grade	Quality Points	Percentage	Interpretation
A	4.00	93–100	Excellent
A–	3.67	90–92	
B+	3.33	87–89	Superior
B	3.00	83–86	
B–	2.67	80–82	
C+	2.33	77–79	Average
C	2.00	73–76	
C–	1.67	70–72	
D+	1.33	67–69	Below Average
D	1.00	63–66	
D–	0.67	60–62	
F	0.00	<60	

Refer to the [WCU Undergraduate Catalog](#) for description of NG (No Grade), W, Z, and other grades. Elements of the course will contribute to the course grade as follows:

- 10% **IN-CLASS PARTICIPATION:** Your participation grade is determined by attendance your as well as your contribution to class activities.
- 15% **COURSE BLOG:** Each student must contribute 2 entries and 4 comments to the course blog. You are welcome to contribute more! At least 1 entry and 2 comments must be completed by November 1 in order to receive full credit.
- 10% **CITIZEN SCIENCE PROJECT:** Each student must contribute 10 hours to the [Zooniverse](#) project of their choice and submit a 1-2 page summary which describes the project and their contribution. A more detailed prompt will be provided later in the term.

40% **IN-CLASS EXAMS:** There will be four exams administered in class during the semester. Each exam is worth 10% of your course grade. No exam score will be “dropped.” Both in-class and final exam scores may be scaled (“curved”) to conform to a standard distribution of grades. Failure to take an exam results in a 0 score.

25% **FINAL EXAM:** The comprehensive final exam is tentatively scheduled for the time listed on page 1. Failure to take the exam results in a 0 score.

I will use the [D2L](#) grade-book feature to post homework and exam scores.

POLICY ON LATE OR MISSED WORK

All deadlines are strict and late work will not be accepted. Rarely, a personal emergency can arise which prevents a student from completing an assignment but does not require the student to withdraw from the course. In such a rare circumstance I am happy to work with the student in order to make appropriate arrangements.

ELECTRONIC DEVICE POLICY

Your personal electronic devices (mobile phone, tablet, laptop) are great learning tools, but they also have the ability to distract you and those sitting near you. The use of devices in class is limited by the course electronic device policy. However, this policy is up to you! I have posted a preliminary electronic device policy on [D2L](#). For the first two weeks of the course students can discuss and suggest amendments to the policy. I will post the final policy will be posted to [D2L](#) on Monday, Sept. 12.

ACADEMIC INTEGRITY

Students are expected to follow all WCU rules and guidelines on academic integrity as described in the [WCU Undergraduate Catalog](#). In particular, let me highlight a few relevant issues for this class:

- **COLLABORATION:** Students are encouraged to study together and collaborate on assignments. However, all work which is to be graded should be generated by you.
- **ONLINE PLATFORMS:** [D2L](#) and the course blog are extensions of the classroom and as such all WCU rules regarding student behavior apply on these platforms. Do not misrepresent your identity on these platforms.
- **TEXT RECOGNITION SOFTWARE:** Students agree that by taking this course any graded written assignment may be subject to submission for textual similarity review to [Turnitin](#) for the detection of plagiarism. Any assignment submitted will be included as source documents in the [Turnitin](#) reference database solely for the purpose of detecting plagiarism of such papers. All identifiers (student name, ID#, etc.) will be removed from the assignment before it is uploaded into [Turnitin](#). Use of [Turnitin](#) page service is subject to the Usage Policy and Privacy Pledge posted on the [Turnitin](#) site.

ADDITIONAL RESOURCES

Below is a short list of popular science texts covering some of the more exciting topics of this course.

- *Project Orion: the True Story of the Atomic Spaceship*, George Dyson
- *Physics for Future Presidents*, Richard Muller
- *Astronomy 101: From the Sun and Moon to Wormholes and Warp Drive, Key Theories, Discoveries, and Facts about the Universe*, Carolyn Petersen
- *The Science of Interstellar*, Kip Thorne
- *Professor Astro Cat's Atomic Adventure* and *Professor Astro Cat's Frontiers of Space*, Walliman and Newman

INTELLECTUAL PROPERTY

The instructor utilizes copyrighted materials under the Freedom and Innovation Revitalizing the 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 copyrighted by the instructor, including, but not limited to, lectures, course discussions, course notes, slides, assessment instruments such as exams, and supplementary materials posted or provided to students authored by the instructor. No recording, copying, storage in a retrieval system, or dissemination in any form by any means of the intellectual property of the instructor, in whole or in part, is permitted without 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 of the semester in which this course is held.

COURSE SCHEDULE

Attached to this syllabus is a tentative schedule of course activities. The precise course trajectory may be altered to better meet our needs as well as to accommodate unforeseen circumstances. I will maintain an up-to-date course schedule on [D2L](#).

UNIVERSITY STATEMENTS

UPDATED: JUNE 2016

The following required statements are common to undergraduate course syllabi. Further information regarding university-wide academic policies may be found in the [WCU Undergraduate Catalog](#) as well as your respective major department handbook.

ACADEMIC & PERSONAL 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 the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the [Physics Department Undergraduate Handbook](#), the [WCU Undergraduate Catalog](#), the [Ram's Eye View](#), and the [University website](#) at www.wcupa.edu.

STUDENTS WITH DISABILITIES

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 [Office of Services for Students with Disabilities](#) (OSSD), please visit them 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](tel: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.

EXCUSED ABSENCES POLICY FOR UNIVERSITY-SANCTIONED EVENTS

Students are advised to carefully read and comply with the excused absences policy for university-sanctioned events contained in the [WCU Undergraduate Catalog](#). In particular, please note that the “responsibility for meeting academic requirements rests with the student,” that this policy does not excuse students from completing required academic work, and that professors can require a “fair alternative” to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, [Ms. Lynn Klingensmith](#). The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the [Office of Social Equity](#) at http://www.wcupa.edu/_admin/social.equity/.

EMERGENCY PREPAREDNESS

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, visit www.wcupa.edu/wcualert. To report an emergency, call the [Department of Public Safety](#) at 610-436-3311.

ELECTRONIC MAIL 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.

COURSE SCHEDULE

UPDATED: August 24, 2016

This schedule is a living document; the most recent version is available on the course [D2L](#) site.

Assignments are categorized as reading (R), writing (W), or project (Proj). Reading assignments must be completed prior to class on the date listed. Writing assignments and the project must be submitted by the time listed on the prompt.

Unit	#	Date	Day	Topic	Reading	Assignment
–	1	8/29	M	Course introduction	1.4-1.5	
1.1	2	8/31	W	Position, velocity	2.1-2.4	
1.2	3	9/02	F	Acceleration	2.5-2.6	W1
		9/05	M	LABOR DAY		
1.3	4	9/07	W	Free fall, graphical integration	2.7-2.9	
–	5	9/09	F	Learning science	–	R1
1.4	6	9/12	M	Vectors	3.4	
1.5	7	9/14	W	2d kinematics	Ch. 4	
1.6	8	9/16	F	Examples	Ch. 4	
2.1	9	9/19	M	Newton's 1st and 2nd	3.3,3.5	
2.2	10	9/21	W	Gravity, normal force	3.6,3.7,5.1-5.4	
–		9/23	F	EXAM 1: Kinematics	–	
2.3	11	9/26	M	Newton's 3rd	3.12	
2.4	12	9/28	W	Examples	3.8-3.11	
2.5	13	9/30	F	Celestial mechanics	–	
2.6	14	10/03	M	Perihelion of Mercury	–	W2
3.1	15	10/05	W	Light	–	W3
–		10/07	F	EXAM 2: Newton's Laws	–	
		10/10	M	FALL BREAK		
3.2	16	10/12	W	Cosmology	–	
3.3	17	10/14	F	Exoplanets	–	R2
4.1	18	10/17	M	Energy, work, momentum	Ch. 7	
4.2	19	10/19	W			
4.3	20	10/21	F			Proj.
4.4	21	10/24	M		Ch. 6	
4.5	22	10/26	W			
–	23	10/28	F	Science in the media	–	R3
4.6	24	10/31	M			
4.7	25	11/02	W			
–		11/04	F	EXAM 3: Energy, work, mom.	–	

Unit	#	Date	Day	Topic	Reading	Assignment
5.1	26	11/07	M	Relativity	Ch. 10	
5.2	27	11/09	W			
5.3	28	11/11	F			
5.4	29	11/14	M			
5.5	30	11/16	W			
5.6	31	11/18	F			
–		11/21	M	Exam 4: Relativity	–	
		11/23	W	THANKSGIVING		
		11/25	F	THANKSGIVING		
–	32	11/28	M	Best of the blog	–	
6.1	33	11/30	W	Nuclear Physics	Ch. 25	
6.2	34	12/02	F			
6.3	35	12/05	M		Ch. 26	
6.4	36	12/07	W			
6.5	37	12/09	F			
–	38	12/12	M	Course conclusion	–	
–		12/14	M	FINAL EXAM	–	