PHYSICS 089: Physics and Science Fiction

Fall 2018

Lecture: Tues/Thurs 9:30-10:45AM

Alumni Hall 7th Floor Auditorium

Office Hours: Wed 10:30AM-11:30AM, Thurs 11:00AM-12:00PM

Contact Information:

Instructor: Melanie L. Good

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Prerequisites: MATH 0020 or any MATH greater than or equal to MATH 0031 (Min Grade 'C') or MATH PLACEMENT SCORE (61 or greater) or SAT Math (620 or greater) or ACT Math (27 or greater)

Books (Required): *Exploring Science Through Science Fiction* by Barry Luokkala

ISBN-13: 978-1461478904

($24.99 on Amazon)

(Recommended):

Don't Try This at Home: The Physics of Hollywood Movies by Adam Weiner

ISBN-13: 978-1419594069

(may be difficult to find but Amazon has used copies starting at around $5.00)

Flatland by Edwin Abbott

(free on Amazon Kindle)

The Time Machine by H.G. Wells

(free on Amazon Kindle)

Course Description:

Physics topics to be covered through the lens of various works of science fiction include:

- Unit 1: The Nature of Science and Basics of Space and Time
- Unit 2: Quantum Mechanics and Electricity and Magnetism
- Unit 3: Newtonian Mechanics
- Unit 4: Relativity
- Unit 5: Space Exploration
- Unit 6: Time Travel
- Unit 7: The Future of Science

Structure of Class: Research has shown that student learning is optimized when students are actively engaged in their learning, so this course will make use of evidence-based approaches to facilitate active engagement. In order to gain the most benefit from these approaches, you will need to be an equal partner in the learning process, which will involve in-class discussions, group work, and coming to class prepared to engage with the content (for example, reading the relevant material in the textbook prior to lecture). Being equal partners in the learning process means that I will arrive to class prepared to serve and support you in your learning through interactive demonstrations, thought-provoking discussion questions, and carefully designed activities. I will also listen intently to any questions or concerns you may have, be sensitive to the diversity of backgrounds of my students, and be accessible to you during my office hours and via email.

Each of the units of physics topics will typically comprise 4 classes. In the first class, you will be given a brief overview of the material for that module, via PowerPoint presentation, with conceptual discussion questions interspersed throughout the lecture. This will give you a chance to think about the material and discuss it with your peers, and receive credit for your discussions via electronic clicker response. If relevant, I will incorporate demonstrations in class. You will be asked to participate in these demonstrations by predicting what you believe the outcome will be, based upon what you have learned. Before the second class in each unit, you will be expected to have read or viewed the relevant textbook pages and/or works of science fiction and to have taken a quiz on Courseweb to help you think about what you have seen and/or read. I will go over the quiz and we will begin discussions related to the works of science fiction for that unit. These discussions will continue in the third class, and during any and/or all of these three classes, you may be asked to complete an exit survey at the end of class (which is essentially like a pop quiz). In the fourth class, you will work in groups to critique one or more works of science fiction for their accuracy in portraying the physics concepts relevant to that unit. During this time, I will be available, as I circulate around the lecture hall, to provide support and answer questions. Variations from this routine may occur, depending on the content and resources available for each unit.

Grading Scheme:
10% Homework Courseweb quizzes
20% Class participation
30% Group work
40% Final project

Important Dates:
Sept. 7 Add/Drop Ends
Oct. 15 Fall "Break" (No classes)
Oct. 16 Monday classes meet, even though it's Tuesday
Oct. 18 Final project proposals due
Oct. 26 Withdrawal Ends
Nov. 15 Draft of final project due
Dec. 4 and 6, Final project presentations in class

Tentative Schedule:

Week	**Tues**	**Thurs**
1	**Aug.** 28 (U1)	30 (U1)
2	**Sept.** 4 (U1)	6 (U1)
3	11 (U2)	13 (U2)
4	18 (U2)	20 (U2)
5	25 (U3)	27 (U3)
6	**Oct.** 2 (U3)	4 (U3)
7	9 (U4)	11 (U4)
8	X	18 (U4 and final project proposals due)
9	23 (U4)	25 (U5)
10	30 (U5)	**Nov.** 1 (U5)
11	6 (U5)	8 (MU6)
12	13 (U6)	15 (U6 and final project drafts due)
13	20 (meet with groups for final project)	X
14	27 (U6)	29 (U7)
15	**Dec. 4 (Final presentations)**	**6 (Final presentations)**

X = No Class

U1, U2, etc. = Unit 1, Unit 2, etc.

Homework:

Your homework will consist of reading the textbook and other materials, viewing videos and taking quizzes on Courseweb. Some of these activities (namely the Courseweb quizzes) will impact your grade directly, while others will have an indirect effect on other components of your grade. For example, your level of preparation at home may show during class discussions.

Class participation:

We will make use of clickers during class. Clicker questions will be formatted as multiple choice questions; however, you will receive 80% credit simply for participating in the clicker response. Should you get the correct answer, then you will receive 100% credit for that question. You do not have to give the same response as the other members of your group–your clicker responses are confidential and individual. Discussions among your group helps you think about what you believe the answer might be, but ultimately you are free to take a dissenting position from the members of your group. In addition, I will expect some informal verbal contribution to discussions, and I will keep a tally count of the number of times you contribute something (more than a simple yes/no response) in class. This tally count will factor into your class participation grade. Finally, you will be asked to complete exit surveys at the end of many classes. These will not be announced in advance, but will count as a portion of your class participation grade.

Group Work:

Group work will be an essential component of your grade. During class, you will work with your group for discussions and critiques of works of science fiction. Your critiques should be written neatly and turned in at the end of class when these activities take place. You will receive a group grade for these critiques. Your group will also work together on your final project. For this you will receive individual grades, based partly on peer- and self-evaluations.

Final Project:

For your final project, your group will first choose a work of science fiction from an approved list and create a proposal to revise the work of science fiction based upon the physics you have learned in class. In the proposal, you should choose at least one aspect of the work of science fiction in which the portrayal of physics could be improved, and at least one physics portrayal that you propose to add which is *inaccurate* but intentionally added based on artistic and/or practical justification. You will need to explain why the physics portrayal that you propose to improve is in need of improvement, what you propose to change about it, and why your revision will be a more accurate portrayal of physics. Likewise, you will have to explain what inaccurate physics you propose to intentionally add and why this addition is justified from an artistic and/or practical standpoint (e.g., aesthetics, cinematography, plotline, limitations in science or technology, etc.). **The deadline for project proposals is Oct. 18**.

After I have approved your proposal and/or given you feedback for revising your proposal, you will work together on implementing your proposal. This means you will choose to either re-write a short-story version of the work of science fiction you are revising, or create a short film portraying the revised work of science fiction. If you opt for the short story, it must be 8-10 pages long (single-spaced, 12pt font), and during the project presentations, you must present a synopsis of the story using a 5 min. PowerPoint (or Keynote, Google Slides, Prezi, etc.) presentation. This synopsis should include a brief summary of the original work of science fiction so that anyone unfamiliar could understand what you revised. If you opt for the short film, you do not need anything fancy–a simple smartphone with video capabilities should suffice. You can choose to act out the revised work of science fiction, or animate it, or use drawings with voice-over,

or stitch together pre-existing video clips, or any other creative way of making a video short that I approve in your proposal. The video should be 5-10 min long, and during project presentations, you will introduce the video by first giving a brief summary of the original work of science fiction so that anyone unfamiliar could understand what you revised, and then you will play the short film for the class. Whether you choose the story or the film, you should be prepared to answer questions from the class or myself after you finish your presentation. **A rough draft of your project is due Nov. 15**. Each group member will receive an individual grade based partly on what I observe about their contribution to the project, and based upon self-evaluations, and peer-evaluations from the other members of your group. However, I will also assign a "group grade" for the project that is the same for everyone in the group and will count as 50% of your grade for the project. In other words, half of your individual grade will come from the group grade and the other half will come from your contribution to the project as discussed above.

Attendance:

A large percentage of your grade comes from in-class activities, so your attendance is absolutely crucial for obtaining a good grade. If you must miss class for health-related reasons, you should notify me in advance of your absence. If you must miss class for an emergency, please notify me as soon as you possibly can. Whether or not you are excused from in-class assignments will be at my discretion. Generally-speaking, if you have been absent more than three times, I will request a doctor's note to justify excusing any further absences. If an absence is unexcused, you will not receive credit for in-class graded activities. If an absence is excused, the activities will be excused from your grade, but there will not be time in the schedule to afford makeups of those activities. Therefore, you will be responsible for ensuring that you understand the material that has been covered in class, as you will still be expected to utilize this understanding in future class work. Feel free to ask members of your group to share any information they have about what you missed, including any group work that was done.

Honor Code:

Students are expected to uphold the University's standard of conduct relating to academic honesty. Students assume full responsibility for the content and integrity of the academic work they submit. Students shall be guilty of violating the honor code if they:

1. represent the work of others as their own
2. use or obtain unauthorized assistance in any academic work
3. give unauthorized assistance to other students
4. modify, without instructor approval, an examination, paper, record, or report for the purpose of obtaining additional credit
5. misrepresent the content of submitted work

Any student violating the honor code is subject to receive a failing grade for the course and will be reported to the Vice President of Academic Affairs.

Disability Services:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 to schedule an appointment. The Disability Resources and Services office is located at 140 William Pitt Union, and is open Monday-Friday from 8:30AM to 5:00PM.