

PHYSICS 111GX SYLLABUS

THE PHILOSOPHY AND ART OF PHYSICS

PRELIMINARY SYLLABUS

Instructors: Prof. Vahé Perroomian, Department of Physics and Astronomy
and Prof. Dana Milstein, Dornsife Writing Program

Email addresses: peroomia@usc.edu, danamils@usc.edu

1. Course Description:

Taken as a complement to Physics 110, this course examines the complex mechanisms through which people acquire knowledge about our physical universe and express that knowledge through creative representation. Questions we will address:

- An interesting thing happens when we begin to question our expectations about the reality and the representation of Space:
 - **Music/ Sound:** What challenges arise when artistic representations defy or completely ignore the reality presented by Physics? For example, how do composers render space “sounds” when most parts of our universe are silent?
 - **Art/ Photography:** How do artists render Space visually when we have limited visibility into our universe?
 - **Literature (Creative and Non-Fiction):** What stories do writers want to tell about Space, and how does that create “degrees of truth” that contradict the absolute truths that science makes claims to?
 - **Philosophy/ Anthropology:** How do scientists use imagination and creativity to develop and test their theories about space?
- Pedagogically, we will also talk about how and why the Humanities and Science got detached as separate forms of inquiry and expression, and how this disciplinary detachment has led to issues of privilege, segregation, and barriers to progress in both the sciences and the humanities.

Learning will be experiential and parallel the themes and activities of Physics 110, through developing scientific papers and posters about Physics Labs in mechanics, acoustics, spectroscopy, and optics; reading of fiction and scientific works; completing digital humanities projects in space cartography, music, and art appreciation field trips; and training in, creating, and exhibiting our own artistic renderings of Space based on our semester’s learning.

***Note: Learners are not expected to be familiar with Physics concepts, nor do they need an artistic talent or humanities computing expertise to fully participate in and succeed in the course.**

2. Course Plan, Reading, and Activities

Units 1-5: General Principles of Physics

Week	Topic	Reading / Activities
1 and 2	Newton's Laws <i>Themes: the how and why of motion</i>	Read. Newton's General Scholium Essay Read. Wilson, <i>The Humanness of Physics</i> Art and Writing Methods: Non-Western visualizations of astronomy: Babylonian Astronomy on Clay Tablets; <i>Tantrasangraha</i> , Kerala school of astronomy and mathematics; Witches of Thessaly
3	Energy and Momentum <i>Themes: production and transfer of energy as well as collisions</i>	Read. Visual Thought Experiments for Physics (i.e., Bell's spaceship paradox, Brownian ratchet, Einstein's Box, Galileo's Ship and the Leaning Tower of Pisa, Kepler's Dream, The Monkey and the Hunter, Newton's Cannonball, Sticky Beat Argument, etc.) Read. Poe's <i>Pit and the Pendulum</i> Humanities Lab Visuals/ Note Taking Activity: Feynman Technique for Storytelling
4	Rotational Motion <i>Themes: dynamics of rotating systems, including stars and planetary systems, torque, angular momentum</i>	Read: <i>A Cultural History of Physics</i> . Drawing Activity: https://www.amazon.com/Drawing-Physics-Years-Discovery-Thales/dp/0262035901
5	Gravity <i>Themes: not just on Earth, but planetary orbits as well</i>	Read. Galileo. <i>Dialogue Concerning the Two Chief World Systems, Ptolemaic and Copernican</i> . 1632. Humanities Lab IMRaD Writing, Scientific Notebooks

Units 6-10: Matter, Energy, Waves

Week	Topic	Humanities
6	States of Matter <i>Themes: solid, liquid, gas, and plasma</i>	Read. <i>A Cultural History of Physics</i> . Writing: Develop IMRaD Paper
7	Thermodynamics <i>Themes: transfer of energy by heat, entropy</i>	Read. Poem: Storey, JWV. "Detection of Shocked Emission from G333.6-0.2." <i>Proc. Astron. Soc. Aust.</i> , Vol. 5, p. 566-568 (1984). Read. <u>Thermodynamics in Art History</u>

		Humanities Lab Thermodynamics in the Arts - Concrete Projects (see examples here)
8	Waves and Sound <i>Themes: oscillations, mechanical waves, propagation of sound waves</i>	Space Music Appreciation (Strauss, Copland, Kouneva, Price, Gregson-Williams, Goldsmith, Giacchino) Radio Astronomy Read. Boethius <i>De Musica</i> , Kepler, <i>Harmonices Mundi</i> Audio Activity: Experimental Sound Group Project
9	Electricity and Magnetism <i>Themes: forces on charged particles in electric and magnetic fields</i>	Read. Ørsted's series "Luftskibet" (<i>The Airship</i>) Visual. Étienne-Gaspard Robert (stage magician, physicist, balloonist) Humanities Lab Photography/ Filming of Space
10	Light <i>Themes: interactions of light and matter, spectroscopy</i>	Read, Alhazen, <i>Book of Optics</i> .

Units 11-14: Astrophysics, Theoretical Physics, and Cosmology

Week	Topic	Humanities
11	Special and General Relativity <i>Themes: The consequences of relativity: time dilation, length contraction, simultaneity, the equivalence principle, gravitational lensing, gravitational time dilation, gravitational waves</i>	Read. Virginia Woolf, "Time Passes" Read. Pippa Goldschmidt, <i>I Am Because You Are</i> Humanities Lab Archival Work/ Visual: Examine Einstein's <i>Zurich Notebook</i> as an artwork/archival work using IIF Technology
12	Formation of the Solar System <i>Themes: Using the concepts of energy and angular momentum to explain the formation of the Sun and planets</i>	Read. Earthrise: <i>How Man First Saw the Earth</i> . Poole, Robert. Read. Zhang Heng, <i>The Spiritual Constitution of the Universe</i> . Visuals: Sculptures, Seals, Artefacts depicting the Solar System across history
13	The Life Cycle of Stars <i>Themes: Bring in concepts related to the formation of heavy elements: we are "star stuff."</i>	Read. Adrienne Rich "Planetarium" (on Caroline Herschel) Read. Caroline Herschel, Observation Notebooks

		Humanities Lab Mapping Activity: History of Star Maps in different cultures
14	Cosmology: Birth of the Universe <i>Themes: Where did our universe come from? Fundamental forces of nature.</i>	Read/View. Aboriginal Astronomy: Stories of Emu in the Sky Read/View. Indigenous Tribes: Peat, David. <i>Blackfoot Physics.</i> Read. Decolonizing Physics

3. Course Guidelines

3.1 Registration and administration

Your registration for this course consists of two separate parts: the lectures and the laboratory. You must register for each of them.

The Undergraduate Physics Office in ACB 439 deals with all administrative aspects of this class. Additional help regarding administrative issues is available from Kimberly Burger in ACB 439 with phone number (213) 740-7728 and email address burgerk@usc.edu.

3.2 Disabilities

Students who need to request accommodation based on disability are required to register each semester with the Office of Disability Services and Programs (DSP). This office can be found at STU 301 with phone number 231-740-0776. A letter of verification to the instructor from the DSP is needed for the semester you are enrolled in. If you have any further questions please contact the DSP or the instructor.

3.3 Grading

Your grade will be determined according to the following key. Please see the rubrics at the end of this document for more detailed assessment criteria for each Assignment type.

Assignment	Assignment Requirements	%
Lab Write-Ups x 4	~500 words each	10%
Reflection Journal, Ancillary Writing	8 informal entries of ~250 words each; lightweight assignments completed in class	15%
IMRaD Paper and Presentation	5-7 page scientific or technical paper	30%
Final Portfolio	Revision of IMRaD, Multimodal Project, & Reflection Write-Up	10%

Digital, Multimodal Project and Presentation	Creation of a project based on one of our lab themes (i.e., interactive map, data visualization, space photography or musical composition)	25%
Participation	Attendance, class discussion, and in-class activities	10%

Attendance & Participation

I use a gradual release model of teaching, which means every week will combine lecture, large and small group, and individual activity that gives you more responsibility and agency for your own work. Attendance and participation in this model is a necessary component of learning. Participation can take several forms according to your personal way of receiving, processing, and expressing information—we will discuss this more in class.

We will schedule a friendly 1:1 conference at least once during the semester to review your progress and strategize for the final.

4. Support

You have a variety of opportunities for support available to you.

4.1 LECTURE

Do not underestimate the value of questions during the lecture period. In large lectures, many students are reluctant to pose questions that they fear might seem silly to their instructor or to their peers. Almost always, if one student asks a question, there are several other students who were wondering about the same issue. Often such questions tell the instructor what material might benefit from a more detailed discussion.

4.2 INSTRUCTOR OFFICE HOURS

I will have three hours of office hours each week, but these office hours will be open to all of the courses that I teach. You can also make an appointment to see me if you cannot make it to any of the office hours listed on the first page of the syllabus. In this case, it is best to contact me by email at least one day before you'd like to meet, or see me immediately after class.

4.3 ELECTRONIC ASSISTANCE

Everyone registered in this course should find a link to the course in their *Blackboard* account. All information about the course will be posted on *Blackboard* at <http://blackboard.usc.edu>.

5. Obtaining Your Grades

You will be able to access your grades in Physics 220 via *Blackboard* at <http://blackboard.usc.edu>.

6. Student Ombudsman

All courses in the Department of Physics & Astronomy have an assigned Student Ombudsman to serve students as a confidential, neutral, informal, and independent resource when they wish to discuss issues concerning their course without directly confronting their instructor. The Student Ombudsman for this course is Prof. Chris Gould, gould@usc.edu, 213-740-1101, SSC 204.

7. *Feedback*

Feedback regarding all aspects of these lectures is very much appreciated and welcome at any time. Please get in touch with your instructor via email, after lectures, or during office hours.

8. *Statement on Academic Conduct and Support Systems*

8.1 ACADEMIC CONDUCT:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

8.2 SUPPORT SYSTEMS:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu

9. SOME USEFUL DATES

August 26	Spring semester classes begin
September 2	Labor Day (University Holiday)
September 26	Midterm 1
September 13	Last day to drop class without a mark of “W,” and last day to change enrolment option
October 24	Midterm 2
November 15	Last day to drop class with mark of “W”
November 21	Midterm 3
December 6	Fall semester classes end
December 12, 2:00 pm – 4:00pm	Final exam

RUBRICS

Case Study/ Lab Analyses (100 pts)	Points	Feedback
Completeness (includes all requirements described in the Tasks section of the assignment)	_____ / 50	
Quality (arguments show logic and critical thinking and are supported by evidence that is properly cited)	_____ / 40	
Style/Form (writing quality, organization, presentation)	_____ / 10	
TOTAL	_____ / 100	General Comments:

Multimodal Project (100 pts)	Mastery	Advanced	Emerging	Points
Preparation (5 pts)	(3.5-5 pts) Clear Purpose Target Audience Identified Information gathering varied and substantial Collaboration demonstrates cohesive and shared effort	(2-3.4 pts) Implied Purpose and Audience Information gathering adequate Collaboration, if any, generally performed as individuals completing tasks, roles, and contributions with a single leader assuming responsibility	(0.5-2 pts) Purpose weak or missing Target Audience not identified Information gathering weak or missing Collaboration, if any, weak or not evidence. Group difficulties with communicating and sharing responsibility	
Content Knowledge (25 pts)	(10-15 pts) message clear, persuasive, and compelling Highly effective use of more or more media formats (i.e., audio, visual, URLs, documents) Information and work are authentic and/or properly cited	(5-9 pts) Message clear and convincing One or more visual formats used but not consistently Some issues with Fair Use, authenticity and/or citation	(0-4 pts) Message confusing and not persuasive Mixed or limited usage of visual formats Excessive copyright infringement, failure to cite borrowed works and wording	
Format Structure (15 pts)	(17-25 pts) Coherent and Organized ideas Categories clear	(9-16 pts) Ideas mostly coherent and organized Categories present	(0-8 pts) Ideas lack coherence and flow Categories weak or missing	
Text Communication (15 pts)	(10-15 pts) Text supports purpose powerful word choice and fluency few to no mechanical errors	(5-9 pts) Text matches purpose adequately Word choice acceptable but may be routine moderate mechanical errors that do not overly	(0-4 pts) Text not appropriate to purpose Word choice dull or inappropriate fluency issues	

		interfere with the message	mechanical errors detract from the message	
Image Communication (15 pts)	(10-15 pts) images enrich meaning images are appropriate and accurate with clear labeling	(5-9 pts) images support meaning appropriateness and engagement attempted but not consistent, labeling may not be accurate or clear	(0-4 pts) images not relevant, used mostly for "decoration" detract from or are inappropriate to content are overused, confusing, or not labeled at all	
Overall Design (25 pts)	(17-25 pts) creative, consistent theme layout intentional balance and unity in graphics, colors, media legible overall design consistent for purpose and audience	(9-16) some pre-made templates design theme appropriate layout balance attempted generally legible transitions but some flow issues adequate appeal but some inconsistency for purpose and audience	(0-8 pts) design inconsistent or inappropriate layout balance not achieved multiple design elements not working readability difficult distracting overall design unappealing or inappropriate for purpose and audience	
Total points/ Grade:				
General Comments:				

Reflection Journal/ Ancillary Writing: Throughout the semester I will ask you to write brief and informal pieces that will help jumpstart your critical thinking and facilitate your larger writing assignments.

Reflection/ Ancillary Work	1	2	3	4	Feedback
Content (reflects an understanding of subject matter for the weekly content)					

Form & Style (grammar, ability to work independently or collaboratively, ability to present material, use of appropriate resources)					
Timeliness (reflects organization, time management, participation)					

1 = standard not met; **2** = standard partially met; **3** = standard met; **4** = exceeds expectations

IMRaD Paper: We use the same criteria established by the Writing Program for 340-courses

A WRITING will:

Undertake a sophisticated exploration of the issues set forth in the assignment. The author is able to negotiate the complexities of the issues raised in a provocative, controlled manner. The author fully responds to the writing task, demonstrating a mature knowledge about the subject and a judicious sense of audience.

Present a decidedly cogent and insightful argument and analysis. The writer responds to the assigned topic in a consistently forceful manner that is not only thoughtful but also thought-provoking and well-articulated.

Provide compelling support for the overall argument and analysis. The author includes a strong balance of extremely well-chosen materials to emphatically support what he or she is trying to do. The writer displays both facility and confidence in the use of primary and secondary materials, and employs them to further his or her own authority and point of view, citing them fully and in appropriate fashion.

Develop its argument or analysis with organizational clarity and logical force. The author directs the writer-reader transaction masterfully and convincingly.

Employ a style that elevates the paper's effectiveness and furthers its purposes in terms of its intended context.

Display professional maturity in syntax. Surface errors are virtually non-existent; the reader is left free simply to enjoy the author's

style and tone as well as the intellectual force of the writing.

Exhibit a distinct appreciation of the academic, professional, and public issues that attend to composition within disciplines, majors, and career fields.

B WRITING will:

Demonstrate strong and purposeful engagement with the issues set forth in the assignment. The author is able to negotiate the complexities of the issues raised with maturity and authority. The author fully responds to the writing task, demonstrating a reliable knowledge about the subject and a good sense of audience.

Present a clear and thoughtful argument and analysis. The writer responds to the assigned topic in a manner that is thoughtful and strongly articulated; the paper demonstrates a strong and often compelling point of view.

Provide effective support for the overall argument and analysis. The author includes a good balance of well-chosen materials to support what he or she is trying to do. The writer displays facility in the use of primary and secondary materials, and employs them to further his or her own authority and point of view, citing them fully and in appropriate fashion.

Develop its argument or analysis with organizational coherence and logical force. The author controls the writer-reader transaction purposefully and effectively.

Employ a style that reinforces the paper's effectiveness and supports its purposes in terms of its intended context.

Display maturity in syntax. Surface errors rarely appear and are inconsequential: the reader is hardly ever distracted by surface matters, and the author's meaning is always clear.

Exhibit an appreciation of the academic, professional, and public issues that attend to composition within disciplines, majors, and career fields.

C WRITING will:

Fully address and explore the issues set forth in the assignment. The paper fully responds to the writing task and explores the complexities of the issues raised. The author demonstrates reliable knowledge about the subject and effectively conveys this to his or her audience.

Present a clear argument or analysis. The writer responds to the assigned topic in a direct, usually thoughtful, and sometimes forceful manner; the paper demonstrates a consistent point of view.

Use effective support and reasoning to bring about the overall project. The argument or analysis receives relevant support; the author includes enough well-chosen material to sustain what he or she is trying to do. The writer incorporates references and sources appropriately, distinguishes between primary and secondary sources, and employs a recognized scholarly apparatus.

Display strong organization, paragraph development, and logical transition. The author demonstrates a good sense of structural control; the paper's form directly contributes to its purpose; transitions are mostly effective.

Use a style and tone that is appropriate to the purpose. The language used supports the author's purposes and is suited to the particular audience -- public, professional, or academic.

Display college-level competence in syntax. Minor surface errors don't seriously detract from the paper's purposes or interfere with the reader's comprehension of the essay.

Conscientiously acknowledge the significance of academic, professional, and public issues attending to different majors, disciplines, and career fields. Upper-division writing is not composed in a vacuum but, rather, attempts to comply with the standards for discourse within specific majors, minors, and career fields as well as those for interdisciplinary audiences.

D WRITING will:

Address the issues set forth in the assignment in a limited fashion. While the paper attempts to explore the complexities of the issues raised in the assignment, it treats them simplistically.

Offer a competent but severely limited argument/analysis in response to the assignment topic. While the argument or analysis may be plausible, fairly clear, and generally consistent, it fails to exhibit the careful thinking and overall cogency necessary for "C" writing.

Incorporate at least minimally appropriate support and references -- properly cited -- to sustain the overall argument/analysis.

The analysis or argument is supported by some credible evidence, but often the support is inadequate, unconvincing, or overly derivative. In addition, an appropriate scholarly apparatus is attempted.

Display baseline competence in overall organization, paragraph development, and logical transition. even if it still exhibits organizational or analytic/argumentative weaknesses. The author demonstrates marginal structural control in that the reader can discern the direction that the writer is taking, and why he or she is doing so.

Use a style and tone intended to be appropriate to the purpose. The language used at least partially supports the author's purposes and is suited to the particular audience -- public, professional, or academic.

Display rudimentary competence in syntax. Existing surface errors don't seriously detract from the paper's purposes or radically interfere with the reader's comprehension of the essay. Indicate some cognizance of the academic, professional, and public issues attending to majors, disciplines, and professions.

F WRITING will offer a limited argument/analysis in response to the assignment while compounding the flaws found in "D" writing. Failing writing will:

Not address the issues set forth in the assignment seriously or sufficiently. The paper treats the issues simplistically; the argument/analysis repeatedly overlooks the complexity of the issues raised. The author, in addition, may fail to respond to all aspects of the writing task.

Exhibit an implausible, unclear, incomplete, or inconsistent analysis/argument. The paper lacks the cogency and purpose necessary for competent college-level writing; the essay consistently fails to exhibit careful thinking.

Contain inadequate, unconvincing, irrelevant, or derivative support. The essay accumulates derivative and/or anecdotal examples without integrating them into a focused analysis or argument. The writer relies on inappropriate or weak sources and reasoning to sustain the overall discussion. The author may not include enough material to support the purposes of the paper. Often, too, such writing fails adequately to acknowledge sources.

Display flaws in organization, paragraph development, or logical transition. The essay lacks structural fluency: organizational flaws cause a lack of overall coherence, undermining the paper's purposes. The reader is too often puzzled by the course the essay takes, or the essay relies too exclusively on formulaic organization, thereby becoming stilted and predictable.

Use an inappropriate style or tone. The manner of expression detracts from the purposes of the essay or is inappropriate to its intended audience.

Contain notable flaws in syntax. Mechanical errors detract from the paper's purposes or interfere with the reader's comprehension. Significant problems in grammar make the writing unclear and confusing.

Fail to pay attention to the importance of the academic, professional, or public issues that apply to writing within different disciplines and career fields.