Physics 89: Physics and Science Fiction | Fall 2025

Professor: Andrew Mugler (he/him), Allen 216, andrew.mugler@pitt.edu

Class: MWF 2-2:50p, Thaw 104
Office Hour: W 3-4p, Allen 216

Textbook: Luokkala, *Exploring Science Through Science Fiction* [on Canvas]
Main works: *2001: A Space Odyssey* (1968) [on reserve at Hillman]
LeGuin, *The Dispossessed* (1974) [on reserve at Hillman]
3 Body Problem (2024-), season 1 [on reserve at Hillman]

Physics topics: Classical, atomic, chaos, relativity, quantum, particle, intelligence

	Mon	Wed	Fri
Aug 25	Introduction	Thu 6:30p: screening	*2001*
Sep 1	LABOR DAY		Signups due 5pm
Sep 8	LeGuin Ch 1-3		Quiz
Sep 15	*3BP* Ep 1, 2		Quiz
Sep 22	LeGuin Ch 4-6		Proposals due 5pm
Sep 29	Asimov, Bradbury		Midterm 1
Oct 6	*3BP* Ep 3, 4		FALL BREAK
Oct 13	Lightman	Presentations	Quiz
Oct 20	LeGuin Ch 7-9	Presentations	Quiz
Oct 27	*3BP* Ep 5, 6	Presentations	Quiz
Nov 3	Gamow	Presentations	Quiz
Nov 10	Abbott	Presentations	Midterm 2
Nov 17	*3BP* Ep 7, 8	Presentations	Quiz
Nov 24	THANKSGIVING BREAK		
Dec 1	LeGuin Ch 10-13	Presentations	Quiz
Dec 8	FINALS WEEK		Reports due 5pm

Topics and schedule subject to change.

Other works: [excerpts on Canvas]
Abbott, *Flatland* (1884); Gamow, *Mr Tompkins…* (1940); Asimov, *Nightfall* (1941); Bradbury, *A Sound of Thunder* (1952); Lightman, *Einstein's Dreams* (1993)

Spoiler alert: [clips in class]
Le Voyage dans la Lune (1902), *Metropolis* (1927), *Planet of the Apes* (1968), *Independence Day* (1996), *Spider-Man 2* (2004), *Despicable Me* (2010), *Elysium* (2013), *Gravity* (2013), *Interstellar* (2014), *The Expanse* (2015-2022), *Lightyear* (2022), *Alien: Romulus* (2024), **more…**

Learning Objectives:

- Gain an understanding of (1) physical laws and (2) physical reasoning.
- Apply to science fiction works: (1) Is it possible? (2) Is it plausible?
- Demonstrate understanding through conceptual reasoning, numerical estimation, class engagement, and written and oral application to a work of choice.
- Build confidence in assessing physical realism within science fiction.

Academic Integrity is of paramount importance. Violations will not be tolerated.
Disability Resources and Services are available for accommodations.
Title IX mandatory reporters include professors. I am required to report violations.

Components:	10%	In-class questions	*No makeups (10 dropped)*
	10%	Works check-ins	*No credit for late submissions*
	20%	Quizzes	*Makeups excused in advance*
	10%	Midterm 1	*No makeups*
	10%	Midterm 2	*No makeups*
	5%	Proposal meeting	*No credit if unscheduled or missed*
	10%	Proposal writeup	*No credit for late submissions*
	10%	Project presentation	*No credit if unscheduled or missed*
	15%	Project report	*No credit for late submissions*
	0%	Suggestion box	*Optional*

- In-class questions: In-class questions (a few per class) will occur using Top Hat. You can access Top Hat through Canvas or using their mobile app. Credit is 80% for participation and 20% for correctness. The purpose is to (1) encourage active understanding, (2) reward attendance, and (3) prepare for the quizzes (see below). The lowest 10 questions will be dropped, to account for a reasonable number of absences. There are **no makeups**, even if the absence is excused.
- Works check-ins: A brief, open-ended question will be asked about each reading or viewing. Answers will be due on Canvas **by Monday at 10am** (Friday the first week). The purpose is to (1) ensure the works are read/viewed and (2) enhance Monday discussions. Questions about the physics can also be asked here (optional).
- Quizzes: A quantitative problem (e.g., an estimation exercise) will be assigned certain weeks. It will not be collected. Instead, it will be given as a quiz on Friday, together with a few of the in-class questions. The purpose is to allow students to work through a problem, using any resources (including each other), before being quizzed on it individually. **Makeups** must be **excused in advance** and **taken within one week**.
- Midterms: There will be two in-class midterm exams. The format will be like the quizzes, but a bit longer and without the questions known in advance. There are **no makeups**.
- Proposal meeting: Each student will analyze a scene or passage from a science fiction work of their choice. The analysis will include identifying the physics concepts and assessing whether the scene is possible and plausible. The first step is to sign up for a brief meeting with me to discuss possible scene(s) and a planned analysis. Sign up for a meeting slot on Canvas **by Sep 5 at 5pm**.
- Proposal writeup: The second step is to write up your proposal, stating your choice of scene and your planned analysis, and incorporating any feedback from our meeting. Proposals are due **Sep 26 at 5pm**.
- Project presentation: The third step is to present your scene and analysis to the class. Presentations will be **5 minutes** each and will occur on Wednesdays in class during the second half of the semester. Sign up for your date **by Sep 5 at 5pm**.
- Project report: The final step is to write up your project, adding your actual analysis to your proposal and incorporating any feedback from your presentation. Reports are due **Dec 12 at 5pm** (the Friday of finals week). There is no final exam.
- Suggestion box (optional): If you have a question about the physics behind a scene or passage from a work of your own choosing, ask it here. Please include a link or file for context. Depending on course timing and structure, I may be able to address it in class.