Course Syllabus for Physics 3200
Physics and Public Policy

Note: This syllabus, schedule and assignments are still subject to slight changes. If that happens, they will be announced in advance.

Class meeting times: Tuesdays and Thursdays (1:00-2:15 pm) at WTS A53
Requirements fulfilled: SO (Social Sciences) or WR (Writing)

Instructor:
Bárbara Cruvinel Santiago (barbara.santiago@yale.edu)
Lecturer, Department of Physics /John B. Madden Dean of Berkeley College

To schedule meetings with me, please make sure to copy my assistant, Allison Van Rhee (allison.vanrhee@yale.edu) in any emails.

Office hours by appointment in the Berkeley College dean's office (entryway F). Call the BK office (203-432-0500 or 203-432-0502) if you have trouble accessing the entryway.

Teaching Fellows:
Morgan Knuesel (morgan.knuesel@yale.edu)
Nathan Suri (nathan.suri@yale.edu)
TA office hours will be by appointment. Please contact the TAs to schedule a time to talk to them if you have questions.

Course Format and Ground Rules: While this course is lecture-based, active student participation is encouraged, and attendance is mandatory. Some topics in the course have political undertones, and we expect any discussions to be carried out in a respectful manner.

Attendance Policy: Attendance is mandatory, and you can have up to 3 unexcused absences without any impact to your grade. In extraordinary circumstances, more absences may be excused or made-up through some alternative arrangement. Please note that dean's extensions cannot cover absences by Yale College regulations. If you have to miss more than 3 classes, please e-mail the instructor and let her know the reason for the absence so we can decide whether it can be excused.

Course Description: Science is driven by innovation and discovery yet subject to the constraints of government, the public, and policy. This lecture course is designed to

give students an overview of how the physical sciences and policy intersect. Topics to be explored include the players in crafting science policy in Congress, at the state level, in industry, in academia, and the public. While most case studies will center around US policymaking, we will also cover a few global policy topics. Ultimately, we hope this course will give students the tools to understand how science policy works broadly, whether they want to work on it as an insider or to be citizen advocates.

This course will sometimes feature guest lecturers.

While in-depth knowledge of physics and math is not required to succeed in the course, some basic understanding might be helpful for specific case studies, particularly towards the end of the term. Physics topics will be introduced as needed. Please contact the instructor if you have questions about this.

If you have questions about whether this course will count towards a major or certificate requirement, please contact your major's Director of Undergraduate Studies directly.

Textbook and Readings: The course will use the book *"Beyond Sputnik: US Science Policy in the Twenty-First Century"* to be coupled with select readings about science policy topics that will be posted on the course's Canvas page. The textbook is available online through the Yale Library system, which also has a few physical copies available.

Assignments: The assignments are split as listed below.

- **Advocacy one-pager and mock lobbying session**

Each student will write an advocacy one-pager in a format typically used in congressional lobbying meetings. We will have a mock lobbying session in which the instructor will pretend to be a congressional staff member, and the students will try to convince her to act on different science policy topics. Instructions on how to write a one-pager and on the logistics of the mock session will also be posted and discussed in class ahead of time.

- **Policy memo**

There will be one 4-page policy memo assigned during the semester. They will be on approved topics in relevant science policy format. For example, a memo could mimic a brief as it would be written by a Congressional Science staffer to his/her Congressperson analyzing a policy issue and making a policy recommendation. Instructions on how to write the memos will be posted ahead of time.

- **Advocacy Op-Ed**

Translating science to layman's terms is essential in advocacy for policy issues. Op-eds play a crucial role in targeting public opinion and policy stakeholders. One of the

course's assignments is to write an 800-to-1000-word op-ed on a science policy issue of your choice. Further instructions and constraints will be shared later in the term.

- **Research paper and presentation**

Each student will write a 6-to-8-page research paper on a science policy topic of their choice and give a brief presentation on it towards the end of the term. More information about suggestions and constraints on paper topics will be posted later in the semester.

Grading Policy: Grading will be based on attendance/participation (10%), the one-pager and mock lobbying session (10%), the policy memo (25%), the op-ed (20%), and the research paper and presentation (35%). Late assignments will have a 5% penalty for every day they are late unless arrangements have been made in advance.

AI policy: Students are welcome to use AI tools such as Chat GPT to brainstorm for writing assignments, but all work, text and research should be ultimately the student's own work.

Writing Resources: If you have questions about how to go about the different writing assignments for this class, you should feel free to connect with the instructor and the TAs. We also highly recommend that you make use of resources in the Poorvu Center's Writing Center, such as writing partners and drop-in hours.

Accessibility: If you have accessibility needs to succeed in this course, make sure to contact Student Accessibility Services (SAS). Please also reach out to the instructor and/or your residential college dean if you have questions on how to get connected.

Class Schedule

Please note that the pace of the class and the list of readings can be adjusted throughout the semester as needed. Please pay attention to course announcements over email and on the Canvas page.

Date	Readings/HW	Concepts	Notes
Section 1: Overview of US Science Policy			
28-Aug	Chapter 1	Course overview. What is science policy? Topics in science policy.	
2-Sep	Chapters 2, 3 and 4 + optional reading and video material	Who gets to make science policy in the US and how?	

4-Sep	Chapter 5 + Extra reading material	Federal research funding and current funding topics. The special case of funding for nuclear weapons in the US	
9-Sep	Extra reading material	Lobbying and advocacy. How to write one-pagers, memos and op-eds.	**Each student should post an op-ed to discuss its effectiveness.**
Section 2: Federal Partners in the Conduct of Science			
11-Sep	Chapter 7 + extra reading material	National labs and their nuclear weapon origins	**Choose one pager topic before class. Form link posted on one-pager assignment description.**
16-Sep	Chapter 6 + ICAN Schools of Mass Destruction Report + Extra reading material	Universities and dual-purpose research	
18-Sep	Chapter 8 + Extra reading material	Industry and quantum information	Guest: Chunyang Ding SY'19
19-Sep	**Lobbying one-pager due by 11:59 pm**		
23-Sep	Chapter 9 + extra reading material	The states and local policy	
25-Sep	Extra reading material and resources	Professional organizations	**Submit form about your mock session preferences before class time (one per assigned group)**
30-Sep		Lobbying mock session	
2-Oct		Lobbying mock session	
7-Oct	Chapter 10 + Extra reading material and resources	Mobilizing the public	**Choose memo topic before class. Form link posted on memo assignment description.** Guest: Matt Caplan
Section 3: Further topics and case studies in physics-related policy			
9-Oct	Chapter 12 and 13 + Extra reading material and resources	Big science, large experiments and infrastructure	Guests: Our TAs!
12-Oct	**Policy Memo due by 11:59 pm**		
14-Oct	Chapter 14 + Extra reading material	Ethics	Guest: Stewart Prager

21-Oct	Chapter 11 + Extra reading material	National security and defense research	
23-Oct	Assignment workshopping with the TAs for op-ed		
28-Oct	Extra reading material	Nuclear security	
30-Oct	Lecture material postponed; assignment workshopping for op-ed and research paper topics		
4-Nov	Chapters 15 and 16 + Extra reading material	STEM education and workforce	**Choose op-ed topic before class. Form link posted on op-ed assignment description.**
6-Nov	Optional resources shared by guest speaker	AI policy	Guest: Max Lamparth; Instructor will be traveling, and class will be on Zoom (link will be sent over e-mail; please check your Canvas notifications.)
11-Nov	Global Warming Primer	Environmental policy	
13-Nov	Extra reading material	Satellite constellations and impact on astronomy	**Choose research paper topic before class. Form link posted on paper assignment description.**
14-Nov	**Op-Ed due by 11:59 pm**		
18-Nov	Chapters 17 + Extra reading material + Optional: Chapters 18, 19 and 20	Global science policy and science diplomacy + wrap-up	
20-Nov		presentations	
2-Dec		presentations	
4-Dec		presentations	
5-Dec	**Research paper due by 11:59 pm**		

<u>Extra reading material and resources:</u>

September 2:

- Optional reading on the budget process: https://www.cbpp.org/research/federal-budget/introduction-to-the-federal-budget-process
- Optional reading on the budget reconciliation: https://www.americanprogress.org/article/how-does-budget-reconciliation-work/

- Optional – this video from 6 to 16 min (not the entire video): https://www.aps.org/events/webinars/2025/effective-meetings-congress-funding

September 4:

- Asplund and Von Hippel on plutonium pit production: https://thebulletin.org/2023/04/dealing-with-a-debacle-a-better-plan-for-us-plutonium-pit-production/
- US Nuclear Modernization Fact Sheet: https://www.armscontrol.org/factsheets/us-modernization-2024-update
- Analysis of federal funding trends: https://ncses.nsf.gov/pubs/nsf24332
- Optional extra infographic: https://ncses.nsf.gov/pubs/nsf25334
- Optional reading on DOGE's cuts: https://www.americanprogress.org/article/how-the-trump-administrations-doge-cuts-are-harming-women/
- Optional reading on biomedical research funding cuts: https://thebulletin.org/premium/2025-05/the-impact-of-doges-funding-cuts-on-biomedical-research-from-the-point-of-view-of-former-nih-director-monica-bertagnolli/
- Additional/optional resource on historical trends for funding: https://www.aaas.org/programs/r-d-budget-and-policy/historical-trends-federal-rd
- Optional resource on funding cancelation tracking: https://physicstoday.aip.org/news/a-crowdsourced-database-tracks-us-science-grant-cancellations

September 9:

- Watch this video from 16 to 55 min: https://www.aps.org/events/webinars/2025/effective-meetings-congress-funding
- Files in the "Memo Guides," "Op-Ed Resources," and "One Pager Examples" folders on Canvas
- Broad Institute tips for policy memos: https://mitcommlab.mit.edu/broad/commkit/policy-memo/
- APS tips for effective meetings: https://www.aps.org/initiatives/advocate-amplify/effective-meetings-policymakers
- APS tips for effective advocacy: https://www.aps.org/initiatives/advocate-amplify/effective-advocacy
- Additional/optional APS resources for congressional meetings: https://www.aps.org/initiatives/advocate-amplify/resources-congressional-meetings

September 11:

- NYT article on nuclear testing fall-out: https://www.nytimes.com/2023/07/20/science/trinity-nuclear-test-atomic-bomb-oppenheimer.html

September 16:

- ICAN's "Schools of Mass Destruction" Report: https://universities.icanw.org/schools_of_mass_destruction
- PBS article on endowment tax: https://www.pbs.org/newshour/education/college-endowment-tax-is-leading-to-hiring-freezes-and-could-mean-cuts-in-financial-aid
- Op-Ed about the state of universities during the Trump administration: https://www.nytimes.com/2025/03/16/opinion/university-defunding-trump-rufo.html

September 18:

- Video and article on why quantum computing is hard to explain: https://www.quantamagazine.org/why-is-quantum-computing-so-hard-to-explain-20210608/
- Video explaining quantum computing at different levels of difficulty: https://www.youtube.com/watch?app=desktop&v=OWJCfOvochA
- Paper on the US National Quantum Initiative: https://iopscience.iop.org/article/10.1088/2058-9565/ab0441
    - Bonus (optional resource) – papers on initiatives in other countries: https://iopscience.iop.org/issue/2058-9565/4/2
- About the Bell Labs' CMB discovery: https://www.aps.org/apsnews/2002/07/discovery-cosmic-microwave-background
    - Optional extra reading – Brief explanation of the CMB: https://courses.ems.psu.edu/astro801/content/l10_p8.html

September 23:

- Optional reading: https://www.scientificamerican.com/article/the-supercollider-that-never-was/

September 25:

- Article on the role of professional societies in policy: https://magazine.amstat.org/blog/2012/01/01/science-advocacy/
- Article about professional societies policy fellowships: https://www.science.org/content/article/phd-policy-wonk-aaas-science-and-technology-policy-fellowships
- Article about the Physicists Coalition: https://www.aps.org/apsnews/2022/08/nuclear-threat-reduction
- Browse through the AIP FYI's website: https://www.aip.org/fyi/about
- Browse through the APS advocacy website: https://www.aps.org/initiatives/advocate-amplify/policy
- Browse through the Union of Concerned Scientists website: https://www.ucs.org/about
- Browse through the Federation of American Scientists website: https://fas.org/about-fas/

- Extra resource – not all-encompassing but helpful science policy fellowships list: https://sites.psu.edu/psusciencepolicy/resources/science-policy-fellowships/

September 30:
No extra readings.

October 2:
No extra readings.

October 7:
- Physics Today article "In Defense of Science Communication:" https://pubs.aip.org/physicstoday/article/78/8/7/3355912/Commentary-A-defense-of-science-communication
- Cruvinel Santiago's Op-Ed on Oppenheimer: https://doi.org/10.1063/pt.xasn.zlyg
- NYT op-ed about nuclear testing downwinders: https://www.nytimes.com/2023/07/30/opinion/international-world/oppenheimer-nuclear-bomb-cancer.html (PDF available on Canvas if needed)
- About March for Science: https://www.science.org/content/article/trump-catalyzed-march-science-where-it-now
- Choose two of the three videos below by our guest speaker to watch:
    - https://www.youtube.com/watch?v=5iPH-br_eJQ
    - https://www.youtube.com/watch?v=wmP3MBjsx20
    - https://www.youtube.com/watch?v=LrIRuqr_Ozg
- Short video by our guest speaker: https://www.youtube.com/shorts/FPZuklD9eRg
- Read description of the Moruora files: https://moruroa-files.org/en/investigation/moruroa-files
- Explore the Missiles on Our Land project website: https://missilesonourland.org/ (you might want to take a look at their data or watch their short movie! It's really interesting!)
    - Alternatively, you can watch the talk by Sebastien Philippe about the project: https://www.youtube.com/watch?v=WKlxmi7305o
- Optional: MacArthur Genius Grant video of ~2.5 min summarizing the two projects above: https://www.macfound.org/fellows/class-of-2025/sebastien-philippe
- Optional/additional resource – our guest speaker's podcast: https://www.npr.org/podcasts/1258979276/twelve-thousand-bombs

October 9:
- Watch "Particle Fever" Documentary: https://www.youtube.com/watch?v=gwCyIIDmGec
- Read LIGO paper on the first gravitational wave discovery: https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.116.061102
    - If that's too difficult for where you're at in physics or too long for you this week, you can choose to read their companion article instead:

https://physics.aps.org/articles/v9/17

- Optional reading about future collider proposal: https://pubs.aip.org/physicstoday/article-abstract/78/8/19/3355917/Europe-s-particle-physics-community-weighs-its

October 14:

- Nature news article about the room-temperature superconductivity scandal: https://www.nature.com/articles/d41586-024-00716-2
- NYT article about BICEP2 premature announcement: https://www.nytimes.com/2014/09/23/science/space/study-confirms-criticism-of-big-bang-finding.html
- Science news article on BICEP2 premature announcement: https://www.science.org/content/article/curtain-falls-controversial-big-bang-result

October 21:

- UCS report on Golden Dome: https://ucs-documents.s3.us-east-1.amazonaws.com/global-security/Golden-Dome-A-Scientific-Assessment.pdf
- Golden dome fact sheet: https://armscontrolcenter.org/fact-sheet-golden-dome/
- NPR article on golden dome: https://www.npr.org/2025/04/22/g-s1-61658/trump-golden-dome-america-iron-military-defense

October 23:

No extra readings.

October 28:

- Feiveson, Glaser, Mian, and Von Hippel "Unmaking the Bomb" Chapter 2 (uploaded to and available on Canvas)
- On nuclear winter:
  - Kurtzgesagt nuclear winter video from October 7 if you have not watched it: https://www.youtube.com/watch?v=LrlRuqr_Ozg
  - Video on nuclear winter if you don't have time to do any of the nuclear winter readings: https://www.youtube.com/watch?v=qsrEk1oZ-54
  - Optional – Dr. Ira Helfand's TEDx talk on nuclear war consequences: https://www.youtube.com/watch?v=mUm82W7B2BY
  - Optional: Their main paper on global famine from nuclear winter: https://www.nature.com/articles/s43016-022-00573-0
  - Optional/additional resources on nuclear winter: https://climate.envsci.rutgers.edu/nuclear/
- Reading on nuclear-powered submarines: https://www.cartainternacional.abri.org.br/Carta/article/view/1299/945 (read at least the introduction and "NNWS with nuclear-powered submarines and the non-proliferation regime" section; please note that while there's a Portuguese translation to the abstract, the article is in English).

- Cruvinel Santiago – article with summary of Brazilian nuclear history: https://thebulletin.org/2022/04/why-brazil-shouldnt-let-bolsonaro-stand-in-the-way-of-ratifying-the-nuclear-ban-treaty/
- Optional resource: UCS/Dylan Spaulding report on plutonium pit production – https://www.ucs.org/resources/plutonium-pit-production
- Optional/additional resources: readings, videos and projects on nuclear testing and missiles from September 11 and October 7 lectures. Also readings about nuclear arsenal modernization and Plutonium pit production from September 4 lecture.

October 30:
No extra readings.

November 4:
- Short video on funding cuts in 2025 and brain drain: https://www.pbs.org/newshour/show/top-researchers-consider-leaving-u-s-amid-funding-cuts-the-science-world-is-ending
- On STEM international students: https://www.csis.org/analysis/innovation-lightbulb-not-just-attracting-retaining-international-stem-students
- On possible F-1/J-1 visa changes: https://oiss.yale.edu/news/dhs-proposes-to-replace-duration-of-status-with-fixed-periods-of-stay-for-f-j-nonimmigrants
- One of the articles on the H-1B visa change: https://www.pbs.org/newshour/economy/trumps-proposed-changes-to-the-h-1b-visa-program-explained (note that the "proclamation" referred to here has now become the executive order)
- Data on physics demographics: https://www.aps.org/learning-center/statistics/diversity
- Reading on DEI executive order/funding cuts: https://www.pbs.org/newshour/politics/supreme-court-lets-trump-cut-783-million-of-health-research-funding-amid-anti-dei-push
- Reading on implicit bias study: https://www.yalescientific.org/2013/02/john-vs-jennifer-a-battle-of-the-sexes/
- Reading on stereotype threat: https://www.pewresearch.org/2006/08/30/women-cant-do-mathor-can-they/
- Optional resource – NYT article on declining number of international students in the US: https://www.nytimes.com/interactive/2025/10/06/upshot/us-international-student-travel.html

November 6:
Additional resources shared by our guest speaker:
- Link to his slides:

https://drive.google.com/file/d/1DsqzCClExpim7LOnQvT8qw8XHaREYwFA/view
- Pitfalls of Evidence-Based AI Policy: https://arxiv.org/abs/2502.09618
- Measuring and mitigating overreliance is necessary for building human-compatible AI: https://www.arxiv.org/abs/2509.08010
- Can LLMs Generate Novel Research Ideas? A Large-Scale Human Study with 100+ NLP Researchers: https://arxiv.org/abs/2409.04109
- AI for Scientific Discovery is a Social Problem: https://arxiv.org/abs/2509.06580
- Could AI slow science? – https://www.normaltech.ai/p/could-ai-slow-science

November 11:
- Global Warming Primer by Jeffrey Bennett: https://www.globalwarmingprimer.com/primer/

November 13:
- 2021 JASON report on satellite constellations: https://www.nsf.gov/mps/ast/updates/jason-report-impacts-large-satellite-constellations (you can read the introduction to each section and skip portions that have too much technical jargon or math that is beyond the level you have taken so far)
- Optional: STATCON1 Report – https://aas.org/sites/default/files/2020-08/SATCON1-Report.pdf
- Optional/additional AAS resources on satellite constellations and their impact on astronomy: https://aas.org/posts/advocacy/2021/08/impacts-large-satellite-constellations-astronomy-live-updates

November 18:
- Council on Foreign Relations – History of UN climate agreements: https://www.cfr.org/backgrounder/paris-global-climate-change-agreements
- Slightly outdated but somewhat comprehensive report on the nuclear non-proliferation regime: https://www.cfr.org/report/global-nuclear-nonproliferation-regime
- ACA fact sheet on the TPNW: https://www.armscontrol.org/factsheets/treaty-prohibition-nuclear-weapons-glance
- Optional – Information about the NPT: https://www.nti.org/education-center/treaties-and-regimes/treaty-on-the-non-proliferation-of-nuclear-weapons/
- Optional resource on nuclear treaties and agreements: https://www.acq.osd.mil/ncbdp/nm/NMHB2020rev/chapters/chapter12.html