Final Projects

Presentations and Reflections due December 4, 2024

1 Overview

For our last class meeting, in place of an exam, each of you will present a project on an astronomy topic of your choice. I have provided a list of suggested projects and topics here, but you are welcome to come up with a topic of your own. All projects must be approved by Lori by **November 13**, and no two topics may be the same, so they will be approved on a first-come, first-serve basis. This is your opportunity to explore something that intrigues *you* about astronomy and to share that in a creative way with us and your classmates – so have fun! Our last class will be dedicated to project preparation. I am available by email or appointment if you would like to get feedback or practice your presentation.

I HIGHLY encourage you to use your own respective hobbies, interestes, or field of study. Powerpoints are perfectly fine, but I would love to see you get creative and show me how you can connect astronomy to your major! For example, a political science major may find doing a final project on space policy interesting, while someone in finance may investigate funding, or a humanities major could be interested in representing space and science through art, and showing that the two are not mutually exclusive. **If you're particularly stuck, I am happy to help you come up with some ideas after you've done some brainstorming of your own.**

You will have at LEAST Lab 9, November 13, to work on and receive feedback on your project, though I encourage you to start earlier if you finish the class labs early.

2 Guidelines

Preparation

- Select a project topic and medium and have your project instructor-approved by **November 13**.
- Prepare a 10-minute presentation about your project to deliver in class on **Wednesday, December 4**. If you'll be using slides, you should submit your presentation slides by midnight on **Tuesday, December 3** (i.e., the night before the presentations). Where appropriate, you should also include references (to, e.g., research papers, popular science articles, websites, books, etc.) in your slides; no special formatting or citation style is needed.
- Prepare a reflection on your project to submit on Courseworks by **December 4** as well.

Presentations

- You are welcome to get feedback from others, but each individual should be doing their own project. I encourage you to work together when allowed during lab time to discuss your ideas, and you will be peer-reviewing each other as well.
- Presentations should be **around 10 minutes in length**

- Each presentation will be followed by a **5 minute question period**
- All presentations should include a description of the science underlying your chosen topic as well as the limitations of our collective knowledge on this topic (see rubric under "Grading" section).
- For research project presentations, you should choose a topic that we have not covered **in detail** in class. You should be learning something new! For your presentation, you may use any combination of slides and/or whiteboard.
- For non-research projects (i.e., projects that creatively interpret a topic we've covered in class), you should also include in your presentation:
  - A description and presentation of the project itself
  - Why you chose this specific medium and how you are using it to convey key information to your audience.
- Come ready to ask questions during and after each presentation; questions will count for a participation grade. Any type of question is welcome (e.g., asking the presenter to clarify a statement, asking the presenter for more background information, asking the presenter hypothetical questions based on relevant scenarios) – remember, there's no such thing as a bad question!

Reflections

- Reflections should be **at least 1 page in length**
- Each reflection should include the following:
  - A description of the underlying science concept and how this concept is connected to previously covered course material. (2 paragraphs)
  - A description of the project itself. (1 paragraph)
  - A description of the key information you want to convey to your audience (1 paragraph)
  - An explanation of why you chose this particular medium and this particular representation of the concept, as well as a justification for why you think this mode of communication is particularly effective (1-2 paragraphs)
  - A summary of what you learned from this project and what else you would like to learn about this topic (1 paragraph)

Grading

The entirety of the final project is worth 20% of your final course grade. This 20% consists of your presentation itself (scored out of 100 points) and the reflection (scored out of 40 points). Here is a rubric [1] for the **presentation**:

Content: 70%

[1] Chiefly adapted from the American Astronomical Society—Chambliss award rubric.

- (35%) Presenter introduces and describe(s) topic at level appropriate to this class [___]
- (40%) Presenter explains extent of and limitations on our knowledge of the topic, including data/observations underlying knowledge [___]
- (20%) Presenter provides context by drawing connections to, e.g., different areas of astronomy, concepts from lab or lecture, other areas of science, areas outside of science, etc. [___]
- (5%) Presenter chooses and cites appropriate references (i.e., goes beyond Wikipedia and popular press releases). Presenter submits reference list. [___]

Delivery: 30%

- (35%) Presentation has a logical flow that audience can follow [___]
- (25%) Presenter can address reasonable audience questions [___]
- (20%) Presentation aids (slides or board-work) or final creative project are understood by audience [___]
- (10%) Presenter stays within allotted time [___]
- (10%) Presenter speaks clearly, and keeps the audience engaged (with, e.g., questions, activities, etc.) [___]

[___] = easily and concisely (4), sufficiently (3), is somewhat able to (2), barely to did not (1)

The project **reflections** will be graded out of 40, with 20 points for depth/thoroughness of explanations, 10 points for clarity of writing, and 10 points for correctness.

3 Suggested topics

Please submit your proposed topics by **6 PM on November 13**.

Below is a list of potential project media as well as a non-comprehensive list of suggested topics. You can choose something not listed, so long as it's relevant to the topics we've covered in lab (e.g., exoplanets, stars, galaxies, cosmology, etc.). If you are doing a research project, you should choose a topic that you haven't covered in depth in class or in this lab.

More focused/specific topics often yield more compelling presentations (and are often better suited for 10-minute presentations). A sufficiently specific topic would be something like "The Great Red Spot and other storms on Jupiter," while something like "Gas giant atmospheres" would require more specificity.

Example Project Ideas:

- A research project (with an associated PowerPoint and/or whiteboard presentation) on a topic we haven't covered in class (e.g., a new astronomy concept, an astronomer/scientist we haven't discussed in class, an instrument/observatory/technique we haven't discussed in class, etc.)
- A description of a museum exhibit that you'd design to teach the public about a specific concept
- A short performance or dialog
- A visual, audio, or mixed-media art piece (sculptures, music, *etc.*)
- A creative writing piece (e.g., poetry or a short story)
- Culinary arts (e.g., baked goods representing some astronomy concept, a "cookbook" on how to create stars/planets/galaxies)

Topic Ideas:

- Galaxies (including our own)
  - Galactic dynamics (e.g., birth, growth, rotation of galaxies)
  - Supermassive black holes
  - Different theories of dark matter (or different dark matter candidates)
  - The intergalactic medium (IGM)
  - Dark matter halos and the dark matter content of different galaxies
  - Dwarf galaxy satellites of the Milky Way
  - Ultra-faint dwarf galaxies
  - Dark energy
  - Galaxy clusters
- Stars (including our Sun)
  - Interior structure and chemistry of stars
  - Asteroseismology or helioseismology
  - Stellar atmospheres or magnetospheres
  - Stellar or solar winds
  - The process of star formation (or the properties of star-forming regions in galaxies)
  - Binary star systems
  - Clusters of stars (globular clusters or open clusters)
  - Specific types of star (e.g., T Tauri, RR Lyrae, Population III (the first stars))
- (Exo)Planets
  - Solar system formation and history
  - Planet X
  - Proto-planetary disks
  - Planet and planetesimal formation
  - Brown dwarfs
  - Exoplanet detection methods not discussed in class (e.g., microlensing, astrometry)
  - Exoplanet atmospheres

- Astrobiology
  - The Search for Extraterrestrial Life (SETI)
  - The Drake equation
  - Dyson spheres (or other hypothetical megastructures)
  - Technosignatures vs. Biosignatures
  - Communication and signal detection; candidate SETI signals
  - Breakthrough Listen or Breakthrough Starshot
- Telescopes and spacecrafts
  - Specific missions/projects (e.g., Hubble Space Telescope, James Webb Space Telescope, Kepler, TESS, Nancy Grace Roman Space Telescope, Vera C. Rubin Observatory, Thirty Meter Telescope).
  - Astronomy at specific wavelengths (e.g., Radio astronomy and very-long-baseline interferometry (VLBI), sub-millimeter astronomy, X-ray astronomy, gamma-ray astronomy)
  - NASA budget, missions, proposals (i.e., how funding decisions are made)
  - Space policy (i.e., laws governing space)
- Controversial Astronomy
  - Planet X
  - Extraterrestrial life
  - Phosphine on Venus
- Miscellaneous
  - The Big Bang and the early Universe (e.g., inflation, nucleosynthesis, the epoch of recombination, the epoch of reionization)
  - The cosmic microwave background (CMB)
  - Gravitational waves and LIGO
  - Compact objects (Black holes, neutron stars, pulsars, magnetars, white dwarfs)
  - High-energy explosions (Fast Radio Bursts or Gamma-Ray Bursts)
  - A biographical presentation on a famous astronomer. If you do this, choose 1-2 scientific contributions to emphasize. Some suggestions for scientists:
    - Annie Jump Cannon (spectra of stars)
    - Cecilia Payne-Gaposchkin (the composition of stars)
    - Vera Rubin (dark matter)
    - Jocelyn Bell Burnell (radio pulsars)
    - Nancy Grace Roman (stellar classification and motion)
    - Jill Tarter (SETI)
    - Sara Seager (exoplanets)
    - Caroline Herschel (comets)
    - Annie Maunder (sunspots, solar corona, eclipses)
    - Margaret Kivelson (solar wind, Europa's ocean)
  - A recent or historically significant astronomy paper (I recommend searching through https://ui.adsabs.harvard.edu/ or https://arxiv.org/archive/astro-ph, or asking me for help finding a paper).