PHYS 172: Stellar Astronomy & Cosmology
Due date: Monday, April 28, 2025 (on Gradescope)

Interlude II: The "Great Debate" of 1920 (Curtis-Shapley)
Instructions

In this second interlude, you will explore the "Great Debate" of 1920, between Harlow Shapley and Heber Curtis, regarding whether the Milky Way galaxy is the entire universe or whether it is one of many galaxies (or "island universes").

Readings
On the Blackboard course site, you will read "The Introduction to the 'Great Debate'" and "Summary of the 'Great Debate'" (both by R. J. Nemiroff and J. T. Bonnell). You should supplement these texts with **at least** one the subsequent additional documents on the Blackboard course site (e.g., those by R. Smith, V. Trimble, and M. Hoskin).

Paper requirements
You will write a reaction paper based on these readings. The paper should be 3-5 pages long (double spaced). A paper longer than 5 pages is fine. The paper should include references (within the text), and the associated bibliography does not count towards the official length of the paper.

Your paper should have at least one quotation from at least one of the three supplementary readings to support your arguments. You may use other references that you find, and those references should be cited as well. When you cite a reference it should be done with a consistent format, which will allow the reader to locate the source. If you are concerned about the citation format, then you can use the MLA citation format:
https://owl.purdue.edu/owl/research_and_citation/mla_style/mla_formatting_and_style_guide/mla_formatting_and_style_guide.html

The paper should be your own writing. The use of artificial intelligence (e.g., ChatGPT) to create or modify your text is NOT acceptable and will be considered an honor code violation. The use of a grammar-checking tool, such as provided within Microsoft Word is acceptable.

Format: 12 point, Times New Roman, 1" margins, 8" × 11" paper.

Grading Rubric
Explanation of the "Great Debate": 30/30
Is the paper's topic and/or the prompt clear?: 10/10
Quotation/citation: 15/15 (i.e., at least one relevant direct quote from the provided readings)
Use of science facts/observations: 20/20
Do your points support your argument: 10/10
Writing style: 15/15 (this category is intended to separate an "A-" paper, where everything is fine, but which has unclear or weak writing, from an "A" paper in which the writing is unambiguous, clear, and compelling. These points are analogous to the "style" points in figure skating.)

Note: Your introduction should state the thesis of your essay.

Late papers: Late papers will be accepted with a 5% per day penalty.

Prompts

You can pick one of the prompts below, or you can choose a question of your own. If you choose one your own, then please verify it with the instructor. Somewhere in the opening paragraph of the paper, you should make clear what your prompt is, e.g. "This paper argues that …" or "This paper compares …".

1. Take Shapley's "side" in the debate: what are the best arguments/evidence, and how would you counter the other side's arguments/evidence? Use only evidence available at the time of the debate.

2. Take Curtis's "side" in the debate: what are the best arguments/evidence, and how would you counter the other side's arguments/evidence? Use only evidence available at the time of the debate.

3. Which side would an educated layperson at the time (not a present-day layperson) be more likely to side with, and why?

4. Did the much larger size of the universe implied in the Curtis picture prevent this view of the universe from being easily accepted? Why?

5. Should the ability of a scientist as a public speaker/debater be allowed to sway a scientific argument such as this? Was it important who was a more persuasive speaker, and why?

6. Is an actual public debate (such as the Shapley-Curtis debate) a useful way to air scientific disagreements? Why or why not?

7. What astronomical observations (made more recently than the 1930's, and not including the Cepheid variable stars seen in M31) would have resolved the debate immediately, if they were available at the time of the debate?

8. Draw analogies between the Great Debate and any present-day scientific controversy. What kind of evidence might be needed to resolve the present-day controversy? Compare or draw analogies with how the Great Debate was resolved.

9. In the Shapley-Curtis debate, both sides were wrong about at least one important point. Choose one of those points and argue whether or not it provided a fatal flaw to either Shapley's view of the universe or Curtis's view.

10. The title of the debate was "The Scale of the Universe". Did Shapley and Curtis even agree on what the actual topic of the debate really was? Explain.

11. Make an argument that one or the other of Shapley or Curtis made the most important contributions to astronomy.

12. Argue that neither Shapley nor Curtis was entirely right or wrong, and both presented ideas that represented major advances. What does this imply for current scientific controversies?

13. Provide arguments, based on the debate, that even very good scientists, when working at the forefront of science, are challenged when coming to a valid conclusion based on evidence that is fragmentary or faulty.

14. Argue that the history of this debate/controversy supports the power of the scientific method to make progress towards a better understanding of the universe, or argue that it exposes flaws in the scientific method.