

# Space: Its Light , Its Shape.

## Hawking Part I: Theories of the Universe

**Assignment:** For Wednesday, March 2

- Read Hawking's *A Brief History of Time* pages 1-20 (Read up to the bit about the postulate of special relativity. This is all of chapter 1 and part of chapter 2.) It is available on eReserves.
- Please feel free to bring up other issues you find interesting or puzzling. If at all possible send an email before seminar to me. I will present this topic as my assignment or open it up to discussion by the whole seminar.
- Some of these require additional reading for the presenting team. If I don't explicitly give the reference then the additional information is easy to find on the internet.
- Though everyone is responsible for reading all of the material and for working out all of the exercises, teams have been specific material and exercises for which they are responsible in class presentations. You may want to come to class early to firm up and smooth out the exercises with your teammates.

**Team 2:** Explain the three arguments recorded by Greek philosophers for why the earth is spherical. Have you had direct experience with any of these observations?

**Team 3:** Hawking points to one observation of Galileo as the "death blow" to the Ptolemaic theory of the universe. What was it?

**Team 4:** Remind us of Newton's equation for the gravitational force.

**Team 1:** Explain the flaw in the idea of an infinite static universe. Start by defining static.

**Team 2:** Present Olbers' paradox.

**Team 3:** Hawking writes that the Big Bang occurred (in our earth-centric units) some 10-20 billion years ago. On the internet find the modern accepted value. (It has 3 significant figures!)

**Team 4:** Summarize Hubble's results (and so our lab). Sketch the situation for an expanding flatland. Using the site <http://www.exploratorium.edu/hubble/tools/center.html> to demonstrate how there may be no center of the universe even though everything is receding from us. Explain this demo with care.

**Team 1:** What is a (scientific) theory?

**Team 2:** What is the role of proof in mathematics and science?

**Team 3:** Do you believe this example of Ping-Pong on a train? What is another example?

**Team 4:** Review for us the method Roemer used to determine the speed of light. Use diagrams in your presentation.

**Team 1:** In physics and astronomy "light" often has a much broader definition than the light that we see. Draw the electromagnetic spectrum and show where microwaves, visible light, radio waves, and gamma rays are. Include a scale with wavelengths.

**Heather and Rose:** Present the Michelson-Morley experiment complete with diagram of the set-up and the result.