

Copernicus, Modern Science, and Astrology

9-12-2005

Opening Discussion

- Do you have any questions about the quiz?
- Have you see anything interesting in the news? What did we talk about last class?
- Losing knowledge (fear of the unknown/ knowledge, stem cells, dispersion of information, societal collapse, locality, creationism)
- Predicting aurora.
- http://www.space.com/php/multimedia/imagedisplay/img_display.1
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Measuring the size of the Earth

- Not only did the Greeks know the Earth was round, they managed to measure the size of the Earth.
- How did Eratosthenes do this? There was something very special about one of the cities he used. What was that and why was it important?

The Copernican Revolution

- The Renaissance was a great time of discovery in Europe and it led to the foundations of modern astronomy and science as a whole.
- Nicholas Copernicus proposed a Sun centered model of the solar system, but he stuck with circles and epicycles so his predictions were no better than Ptolemy's.
- Tycho Brahe was the greatest naked eye observer ever. He compiled observations of the planets accurate to 1 arcminute. He died a rather untimely death, but asked his student to make use of his observations.

Kepler's Laws

- Johannes Kepler had such great faith in the accuracy of Tycho's observations that he developed a model that didn't use circles based on 8 arcminutes of discrepancy.
- Kepler developed 3 laws of planetary motion in a heliocentric model.
 - Planets orbit in ellipses with the Sun at one focus.
 - The line from the Sun to the planet sweeps out equal areas in equal times.
 - $p^2=a^3$ (p is period in years and a is semimajor axis in AU)

•Galileo

- The heliocentric model didn't become the default until Galileo Galilei turned a telescope to the sky and tore down most of the beliefs of Aristotle.
 - He saw that the Sun had sunspots and the Moon had craters and mountains.
 - He found that the Milky Way was made of stars.
 - He saw 4 moons orbiting Jupiter.
 - He saw that Venus has Phases.
- Galileo also demonstrated that objects continue to move unless acted on by an outside force.

Science

- Science can be discovery driven or hypothesis driven.
- To be science we need three things:
 - Seek explanations for observations that rely on natural causes.
 - Progress through the creation and testing of models that explain things as simply as possible.
 - A scientific model must make testable predictions and when observations don't match, models are modified or discarded.
- A model that has stood up to repeated testing is elevated to the status of a theory.

Pseudoscience

- Claims that make statements about the observable world, but ignore evidence are called pseudoscience.
- In pseudoscience, people either make claims that are testable and ignore the evidence, or they make claims that are sufficiently vague as to be impossible to test.
- Unfortunately, pseudoscience looks like real science to most people. The best way to not be taken in is to have a better understanding of what we know from science. Science can have bias too, but with experimentation over time, the better model wins.

Astrology

- Historically astronomy and astrology was closely tied with the same people doing both. In many ways, astrology paid for early astronomy.
- The idea of astrology is that the positions of the Sun, Moon, and planets among the stars impacts our lives. In many ways it is true for the Sun and Moon in that they control seasons and tides. However, with what you now know about the stars and the planets you can fairly easily see that the claim that the location of the planets against the stars as seen from Earth quite literally has no impact upon you at all.

Minute Essay

- What is something that you think qualifies as pseudoscience? Why do you feel it qualifies as that?
- History lessons are over and it is time to start some physics. Remember to read 4.1 and 4.2 for next class.
- Feel free to read S1 as well. It is interesting stuff and might help you solidify some of the concepts we have covered. You won't be directly tested on it though.