Origins of Cosmology

Friday, September 25

Cosmology is based on observation of the universe around us.

Looking WSW, 5:30 pm today

Sun ↑

Sky (blue)

horizon

Earth (opaque)
Cosmology version 1.0: Domed sky over flat earth.

And God said, “Let there be a vault in the midst of the waters, and let it divide water from water.” And God made the vault and it divided the water beneath the vault from the water above the vault, and so it was.

– Genesis 1:6

[Robert Alter translation]

Aristotle (4th century BC): First to give reasons why the Earth is spherical.
Aristotle’s 1st reason:
Gravity pulls matter to center of Earth, compressing the Earth into as compact a shape as possible.

2nd reason:
You see different stars from the south than from the north.

If the Earth were flat:
3rd reason:
The shape of the Earth’s shadow.

During a lunar eclipse, Earth’s shadow is always circular. Only object whose shadow is always circular is a sphere.

Other reasons were given later:

Ships disappear “hull-down”.

How large is the Earth?

Question answered by Eratosthenes (ca. 200 BC).
What Eratosthenes read: At noon on June 21, Sun is at zenith seen from Syene.

What he saw: At noon on June 21, Sun is 7.2° south of zenith seen from Alexandria.

What he assumed: Earth is spherical:
Sun is very far away.

Angle $\alpha = \text{angle } \beta = 7.2^\circ = 1/50$ of circle.
Distance $D = 1/50$ of circumference.

Circumference of Earth = $50 \times$ distance from Alexandria to Syene.

Distance from Alexandria to Syene = 5000 stades
Circumference of Earth = $50 \times 5000$ stades = 250,000 stades.

(about 46,000 kilometers – true value is 40,000 kilometers)
Looking north, 8:30 tonight.

Constellations
Constellations are arbitrary (but useful).

Stars in a constellation are not all at the same distance from us.

8:30 pm

12:30 am
Constellations appear to travel in counterclockwise circles around Polaris (the North Star).

Strong visual illusion: stars are attached to a **celestial sphere**, rotating around the Earth.

Cosmology version 2.0: Celestial sphere surrounding spherical Earth.

- Stars attached to celestial sphere, which rotates.
- Earth stationary at center.
This *geocentric* (Earth-centered) model was generally accepted from ancient times until 16th cent. AD.

Dante

*Divine Comedy*

AD 1300

Monday’s Lecture:

Ancient Cosmology

Please read these chapters in the text:

Chapters 1 & 2