

Chapter 3 Ancient Cosmologies

The Flat Earth

Almost all ancient, pre-scientific civilizations envisioned a flat earth. Their cosmology may have varied in detail, but the basic concept was that the earth was a plane or a disk floating on water or air covered with an inverted bowl. For some, the base of the universe was a rectangle making it look more like a round top trunk than a domed stadium. In every case, the firmament (the cover) was a real physical object held up by the water and/or invisible pillars. Stars, tiny things, were attached to the firmament. The wondering stars (planets), the sun, and the moon, all small objects, were placed about 200 miles above the earth and somehow moved across the sky.

The concept of the spherical earth first developed in Greek astronomy with Pythagoras in the 6th century BC with some rather convincing observations however the idea of such a world was not readily accepted. It wasn't intuitive or logical. Too many other concepts had to change to allow such a world. Most Pre-Socratic philosophers held on to their flat earth model some modifying them to account for the observations. Archelaus believed the world was depressed in the middle like a shallow bowl to explain the observation that the sun did not rise or set at the same time for everyone. It was not until Aristotle endorsed the idea on empirical grounds in 330 BC that the concept of the spherical earth gained purchase and spread throughout the world. China retained its flat earth model until the 17th century.

While there may have been individuals who believed the world was flat there were no serious advocates for such a cosmology in the west after the 1st century BC until Samuel Birley Rowbotham, under pseudonym "Parallax" published a 16 page pamphlet, "Zetetic Astronomy. Earth Not a Globe" announcing a series of lectures on the subject in 1849. His first lecture did not go well when he couldn't explain why the hulls of ships disappeared before the masts, he ran off the stage. However this did not dissuade him from his cause. He re-invented himself; learned his trade; expanded his pamphlet; honed his debating skills and resumed to his campaign delivering convincing lectures with wit and humor. His 16 page pamphlet grew to a 221 page book published in 1865 followed by a third and final edition, a 430 page book published in 1881.

In his lectures, Rowbotham steamrolled all opponents by appealing to the audience to use "common sense" and referencing the Bible making it difficult to counter without seeming godless. Except for the Book of Enoch that describes the earth as a domed stadium, the Bible does not directly declare that the earth is flat, it is implied. For instance, the order of creation with the creation of the sun and stars on the fourth day is only logical for a flat world. This should not be surprising since the ancient Hebrew had a flat earth cosmology. In his lectures he told his audience that might as well throw their Bibles away if they thought the earth was a globe.

To Rowbotham the earth is flat. The continents float on an infinite ocean with a layer of fire beneath. The known world is surrounded by an infinite expanse of snow and ice bordered by an immense circular "ice-cliff." The North Pole is the center of the earth.

The sun, moon, planets and stars, all tiny, are all a few hundred miles above the earth. The sun orbits around the North Pole at a constant altitude. The moon glows on its own and not by reflected light. Eclipses are caused by unknown object occulting the sun or moon.

The basis for Rowbotham's claim that world was flat was a series of observations he made in 1838 on a slow flowing drainage canal of the Old Bedford River that ran uninterrupted in a straight line for 6 miles. In one of his experiments he waded into the middle of the canal and with a telescope mounted just 8 inches above the surface of the water watched a boat with a 5 foot mast row away from him to the bridge six miles away. He could still see the banner on the mast at the end of the journey when the boat should be 11 feet below the line of sight!

Over the next 66 years the Bedford canal became the site for a series of experiments by a multitude of individuals with the objective of verifying or debunking Rowbotham's flat world claim. These Bedford Level experiments had mixed results with early observations seeming to verify a flat world but the turn of the century the tide had turned with a spherical earth almost universally accepted. On May 11, 1904 Lady Elizabeth Blount, founder of the Universal Zetetic Society, hired a commercial photographer to take a picture from Welney of a large white sheet she had placed,



Figure 9. Lady Elizabeth Blount hired photographer Edgar Clifton to take this picture at the Bedford Levels. In misty weather on May 11, 1904 with a camera equipped with a telephoto lens Clifton took the picture of a large white sheet with one end of the sheet touching the surface six miles away.

touching the surface of the canal six miles away. The photographer mounted the camera equipped with a telephoto lens 2 feet above the water and in terrible, misty weather was able to take a picture of the target. He was surprised that he could see the sheet from such a low position. Lady Blount published the picture far and wide countering the refraction explanation for the Bedford phenomena and once more had a surge of flat worlders.

After World War I, the “flat earth” movement suffered a slow decline until Samuel Shenton of Dover, England founded *The International Flat Earth Society* in 1956. However it was not until advent of manned spaceflight that he was able to attract wide attention claiming that the Apollo Moon landings were a hoax staged by Hollywood and thus attracting many who believe likewise not associated with the society.

The flat world envisioned by the new society was almost identical to Rowbothm’s model except that the sun and Moon are 3000 miles above the earth surface and the firmament is 100 miles above that. The sun and the Moon are 32 miles in diameter.

When Shenton died in 1971, Charles K. Johnson of Lancaster, California, inheriting Shenton’s library, became head and energetic promoter of the *International Flat Earth Society* until his death in 2001. Under his leadership, the society grew to 3000 paying members. The fundamental basis for the *International Flat Earth Society* is Rowbotham’s work, *Zetetic Astronomy: Earth Not a Globe*. The arguments have remained the same, the observations have remained the same, more examples have been added, the model is basically the same with some modifications in distance and size of objects, but each new leader has added an element to broaden appeal. To the lunar landings hoax, Johnson added a conspiracy theory claiming that the ‘elites’ know the world is flat and were about to make it known to the general public but for some reason changed their mind. As proof he points out the United Nations’ flag which is identical to their flat earth model.

The Geocentric System

The geocentric model of universe, like the concept of the spherical earth, started with the Greeks in the 6th century B.C. The basic design was a series of concentric spheres with the earth in the center and a sphere for each of the visible celestial bodies, the Moon, the sun, the “wandering” stars (planets) and the fixed stars. Each sphere revolved around the immobile earth’s north-south axis at different rates. The spheres, starting from the center outward, were arranged in the following order: the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn and the fixed stars as shown in the figure below. The order was not determined by observation but aligns with Seven Heavens religious tradition.



Figure 10. Geocentric Model

Almost immediately the astronomers detected a problem with the model; the planets did not revolve around the earth at a constant rate against

the background stars. They would speed up and slow down and some would stop and actually go backwards (retrograde motion) for a while then continue on their journey. This is because planets' orbits are elliptical, not circular, and the earth is not in the center as drawn by the model. However this ran counter their concept of perfection. In their minds the orbits had to be circular. To adjust the orbit to what was observed the astronomers added epicycles at certain points along the orbit. Epicycles were little circles added to the circle of the orbit. According to this model, the planet, for some unknown reason would loop back tracing a perfect circle to the inside or outside of its orbit then continue in its original trek.

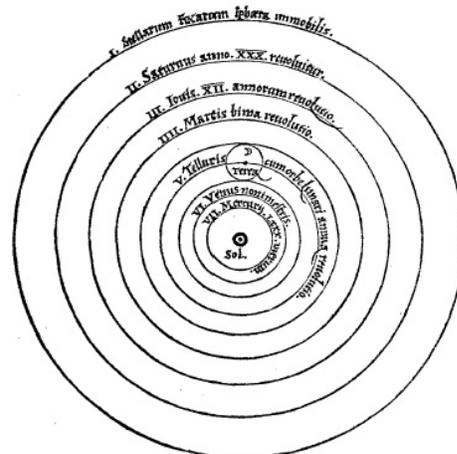
The basic tenets of the geocentric system were in place by Aristotle's time, but it was not accurate or workable until Claudius Ptolemy refined the model that would be the system for over 1500 years in the 2nd century A.D. Ptolemy noticed that the epicycles were of different sizes even for the same planet and developed a sophisticated rationale to explain it with the restriction that all celestial bodies moved in perfect circles around the earth. Ptolemy believed celestial bodies moved in multiple spheres that were interconnected. The epicycle revolved around the 'equant' an imaginary point from which the center of epicycle moves uniformly. The orbital sphere revolved around the 'deferent' an imaginary point half way between the 'equant' and the earth. Each orbital body had multiple 'equants' and 'deferents.' Over the generations the number of epicycles grew to over 80. As complex and contrived this may have been, it resulted in most remarkable methodology ever devised to view the heavens from earth. As unwieldy as it had become it was still more accurate than Copernicus' heliocentric model with its circular orbits.

With his combination of epicycles and deferents, Ptolemy had made the circular orbits elliptical by changing its focus. In the Ptolemaic geocentric model, the earth was not quite in the center.

The Heliocentric System

Copernicus was not the first to propose a planetary system with the sun at the center; that honor belongs to Aristarchus of Samos who proposed it in the 2nd century B.C. as mentioned earlier in this document, however this should not diminish his accomplishment. And you have to admire the Polish priest's courage in presenting such a radical alternative to Ptolemy's well-entrenched system.

Strangely enough this radical view was triggered by an older authority: Aristotle's dictum that celestial bodies move in uniformly in a perfect circle. Copernicus did not like the concept of the 'equant' or the 'deferent.' This was not the first time Ptolemy's work had been questioned. In the 10th century, Islamic astronomer Ibn al-Haytham wrote a treatise very critical



Copernicus' Solar system

Figure 11 Copernicus' Solar System

of Ptolemy's work saying that such an arrangement could not exist.

As elegant and aesthetically pleasing solution to the orbit determination problem afforded by the heliocentric system, it was not readily accepted and not just on religious grounds; the increasingly unwieldy geocentric system was far more accurate. Copernicus had to employ epicycles to adjust the model to what was observed. Galileo Galilei accepted the model. It fit nicely to what he observed and afforded a great rationale for the phases of the Moon. Johannes Kepler liked the Copernicus' model on aesthetic grounds. It satisfied his sense of logic. It is at this juncture that you have of the great ironies in astronomical history. Kepler was an assistant of Tycho Brahe. Brahe, recognizing Kepler's genius, mistrusted him and would not grant Kepler access to his voluminous data fearing that the brilliant mathematician would eclipse his fame. He finally yielded giving Kepler the data for Mars which was the most troublesome. And it was this very data that gave Kepler the insight that the orbit was an ellipse and not a circle that in turn lead to the discovery of his greatest achievement; the laws of planetary motion. It was these laws that led to the acceptance of the heliocentric system over the geocentric model.