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Geocentricity At A Glance

The most important concepts presented in the Geocentric Model of the Solar System illustration above can easily be identified by observing the white text against the black backgrounds.

Introduction: First proposed by **Aristotle** (384-322 BC), the Geocentric Model of celestial objects depicts the Moon, Sun, all planets and all stars orbiting Earth in circular orbits and at different speeds. Aristotle believed in the existence of crystalline rotating spheres, 55 to be exact, and onto these spheres all the heavenly bodies were attached. He believed that an outer sphere, not shown in the above diagram, was the "Prime Mover" that rotated at a constant velocity, imparted motion to the inner spheres causing the entire universe to rotate.

Epicycles, similar those shown in the illustration above, were devised to explain the Retrograde (backward) Motion of outer planets, as seen from Earth.

Because a single epicycle did not fully explain nor deal with the retrograde issue, **Ptolemy** (90-168 AD) devised an even more advanced proposal consisting of epicycles on epicycles. In the Ptolemaic Universe a planet orbited on one epicycle which orbited a second epicycle which then revolved on the main orbit around the Earth. Ptolemy also believed in the existence of fixed crystalline spheres.

A Non-Rotating Earth is Fixed at the Center of the Universe

Within the Geocentric model, in order for planetary objects to move around the Earth, changing position in the sky each day or over the course of a year, the Earth had to remain fixed and it could not rotate. A non-rotating Earth would allow celestial objects to orbit our planet then disappear from view as they traveled past the opposite side of our planet. This *fixed-Earth concept* would appear to explain all the phenomenon observed in the celestial skies: sunrise and sunset, moonrise and moonset, seasonal constellations and the movement of other planets.

Also worth noting is the absence of Earth's axis tilt, the major cause of seasonal temperature changes on Earth. There would be no need for an axis tilt since the Sun's changing positions as it orbits our planet would explain differences in intensity of sun insolation.

Perhaps the Geocentric Model can be thought of as the Egocentric model. Lacking sophisticated, modern instruments, simple ignorance allowed people who lived centuries earlier to consider themselves at the center of the universe with every other celestial object revolving around them.

Moon Revolves Around Earth

The moon rises, travels through the sky, and then sets each day, most obvious when a Moon Phase is visible. Therefore, in the Geocentric Model, the Moon was depicted in a circular orbit, revolving around Earth. This aspect of the Geocentric Model was correct. The Moon does revolve around Earth.

Planets Orbit the Earth in Epicycles

All planets were believed to revolve around a fixed, non-rotating Earth in circular orbits and at different speeds.

Consider this: If Earth did not rotate and the planets did not revolve around us then they would be visible in the sky all the time and in the same positions. But, planets appear and disappear from view and they are seen at certain times of the year and not at others so the logical conclusion was, if Earth did not rotate then the planets must travel around us. Centuries ago, what other explanation could there be?

Epicycles Explain the Retrograde(backward) Motion of Outer Planets

Consider 2 cars driving down a highway each in its own lane but next to each other. If one car speeds up and travels faster than the other, the slower car appears to be moving backwards. Of course it is not doing so. It is an apparent motion. In reality, because Earth is closer to the Sun in its orbit than Mars is, Earth makes one complete revolution before Mars completes one orbital year. As Earth revolves around the Sun it passes Mars and it appears as if Mars is traveling backwards. This presented a problem for early astronomers who placed all the planets in a circular orbit around the Earth. If the planets orbited a fixed Earth then there should never be a time when any planet would appear to be moving backwards.

In order to compensate for this anomaly, additional orbits, called epicycles, were created for the outer planets. Thus, a planet would move in a smaller orbit as well as along the larger orbit around the fixed earth.

The epicycles seen in the illustration above are actually more simplistic than the Ptolemaic Geocentric Model which incorporated epicycles on epicycles to deal with the Retrograde Motion problem.

The Sun Orbits the Earth

Because the sun is seen rising, moving across the sky then setting everyday, it would appear only natural that people might believe the sun actually orbited the earth in a circular path.

Stars Orbit the Earth

Stars and constellations of stars change their position in the sky throughout the year. In fact, some constellations are only visible from Earth during specific times of the year. Therefore, it was believed that the stars must orbit around Earth as well. In the Geocentric Model the stars are all located at the same distance from Earth, fixed on one singular orbital path.

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[The Heliocentric Model of the Solar System Lesson](#)
[Geocentric versus Heliocentric Models of Celestial Objects Assignment](#)

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Supplemental Resources that will assist in the understanding of concepts presented in this lesson:

Retrograde Motion - [Retrograde-O-Matic 2000](#)- Excellent Interactive Animation
Geocentricity - [The Universe of Aristotle and Ptolemy](#)

Seasonal Constellations- Changing Positions of Constellations in the Sky

Observing the Sky: Constellations - Seasonal When you go there, be sure to click on the links for each of the 4 seasons. The picture will change. Notice the constellations in the night sky.

Motion of the Sun and Stars - The Night Sky Be sure read the page and click "Next" to play the animation.