

FOCUS ON

Grades 5-8

MIDDLE SCHOOL

Astronomy



Rebecca W. Keller, PhD



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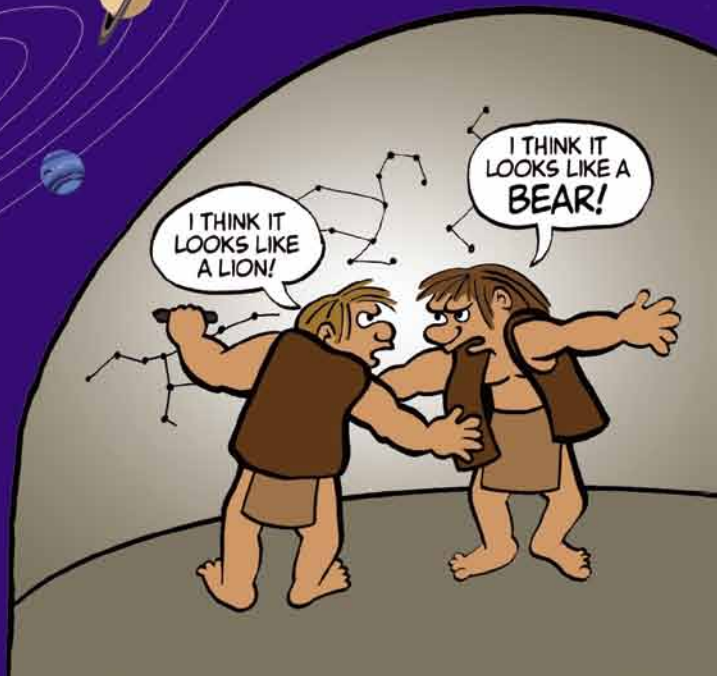
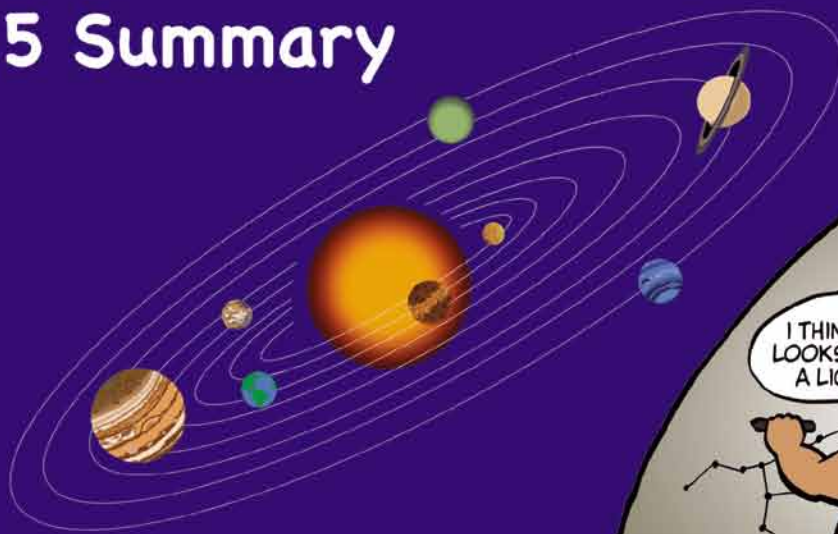
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1.1 Introduction

Astronomy is considered by many to be the oldest science. Since long before the invention of the telescope, human beings have been looking at the stars. The word **astronomy** (ə-strä'-nə-mē) comes from the Greek word *aster* which means "star" and the Greek word *nomas* which means "to assign, distribute, or arrange." The word astronomy literally means "to assign or arrange the stars." **Astronomers** are scientists who assign names to all the **celestial** (sə-les'-chəl) **bodies** in space, including stars, and study how they exist and move in space.

1.2 Early Astronomers

The earliest recorded history reveals an interest in the stars. Cave drawings show primitive humans recording observations from the skies, and later the Babylonians (ba-bə-lō'-nyənz) recorded detailed planetary positions, eclipses, and other astronomical observations. Egyptian and Greek observers expanded on the information collected by the Babylonians. The alignment of the pyramids with the **North Star** suggests that the Egyptians acquired sophisticated abilities to observe the sky. The Ancient Greeks were the first astronomers to add mathematics to astronomy.

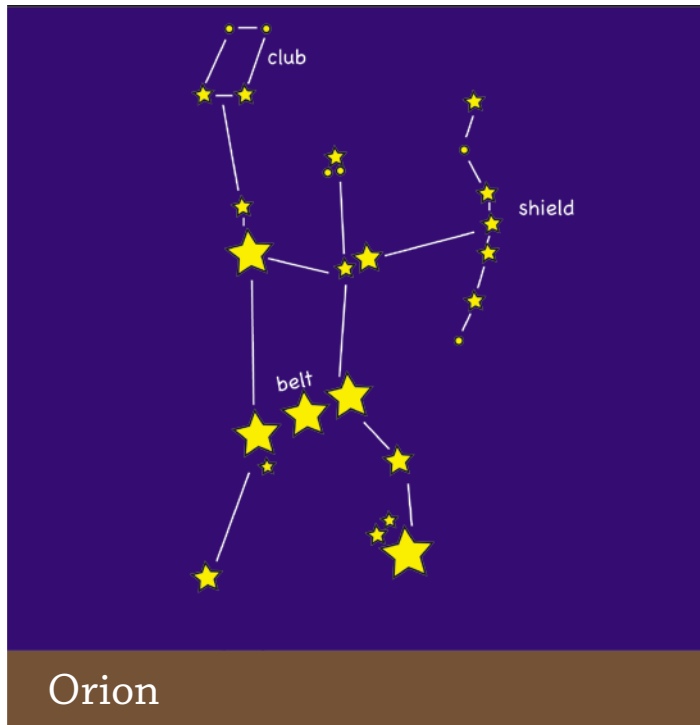
Many early civilizations used the stars and the movements of **celestial bodies** as tools to measure time. The Sumerians (sü-mer'-ē-ənz) of Babylonia used the **phases of the Moon** to create the first lunar calendar, and



the Egyptians, Greeks, and Romans copied and revised this calendar. Today our calendar is derived directly from the Sumerian calendar and is connected to the monthly and yearly orbits of the Moon and Earth. On the other side of the ocean, the Incan and Mayan civilizations created sophisticated calendars by observing the planetary cycles. The Mayan calendar is circular and has aspects that relate the movement of the Sun, Moon and planets.



Early astronomers named individual stars as well as groups of stars that form **constellations** (kän-stə-lā'-shənz). A constellation is any group of stars that fit



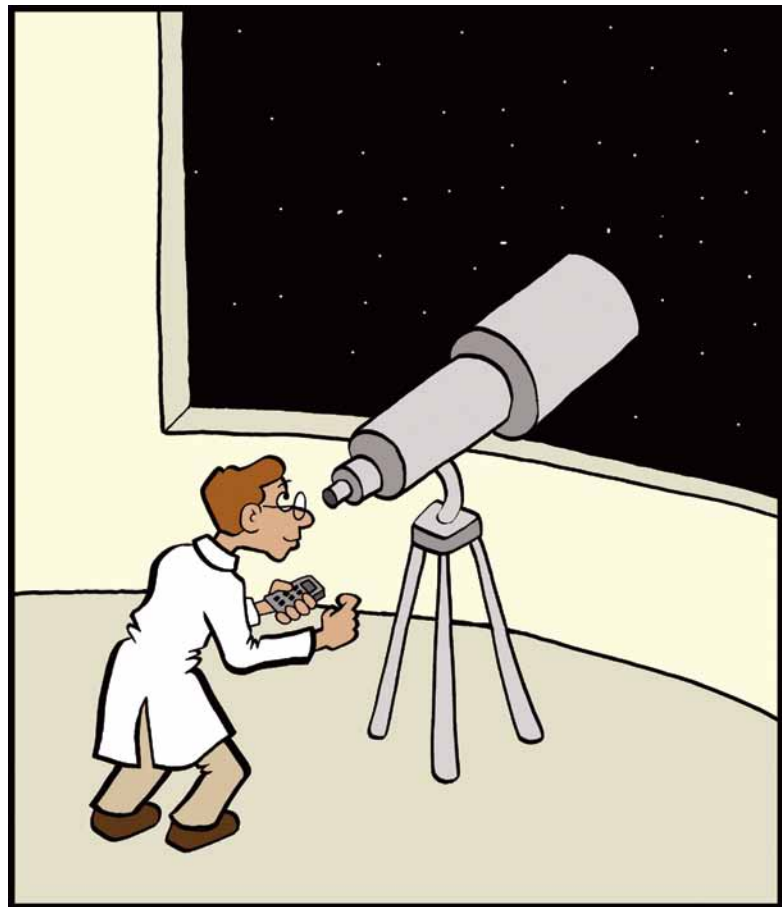
together to form a pattern in the night sky. Some of the major constellations that come from Greek mythology are familiar to many people. **Orion** (ə-rī'-ən) the Hunter is a constellation of stars that can be seen from the **northern hemisphere** from December through March. Orion has a "belt" of three bright stars in a straight row. Once the "belt" is located, it is easy to find the "club" and "shield" by looking for neighboring stars.

The constellation names derived from Greek mythology have changed very little since 1000 BC (BCE). There are currently 88 constellations that are recognized by the **International Astronomical Union (IAU)**, and over half of those were observed by the ancient Greeks!

1.3 Modern Astronomers

Today, astronomers can see many more stars than their ancient predecessors could. Modern astronomers can also see details about the planets and stars that were not visible in ancient times.

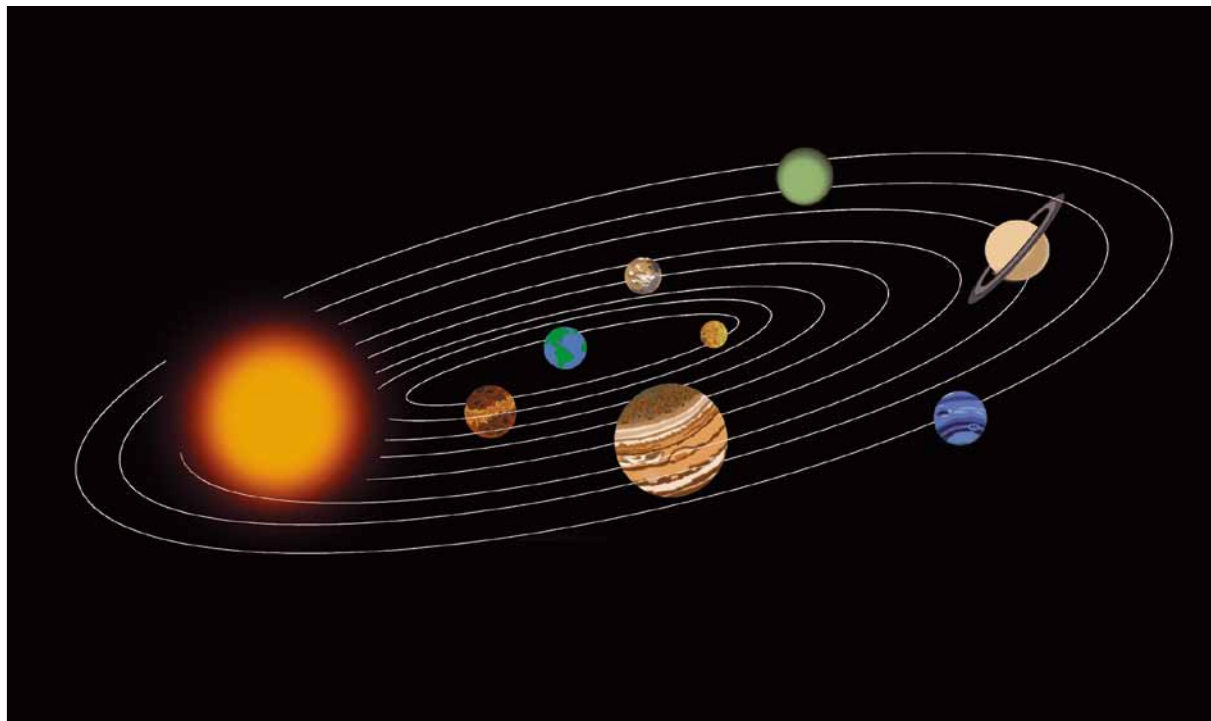
In Chapter 2 we will look closely at the tools a modern astronomer uses to look at celestial bodies. Telescopes, radios, and cameras are just some of the tools astronomers use when studying the planets and stars. Modern astronomers also use **chemistry** and **physics** to understand astronomical data. Understanding how planets move requires knowing the physics behind **gravity, inertia, and mass**. Understanding how stars give off heat and light energy requires knowing the chemistry behind nuclear reactions. And understanding how the Sun affects our weather requires knowledge of **magnetic** and **electric fields**. Modern astronomers not only have sophisticated tools to explore the universe, they also have centuries of complicated mathematics, chemistry, and physics to help them understand how the universe works.



1.4 Changing Views of the Cosmos

The practice of astronomy changed dramatically after the invention of the **telescope**, a scientific tool that uses lenses to magnify distant objects. In the 1600s **Galileo** (ga-lə-lā'-ō), an Italian scientist considered to be the first modern astronomer, used the telescope to look at the planets. Galileo was also able to see the moons of Jupiter and the rotation of the Sun. Based on his observations, Galileo confirmed a radical new view of the **cosmos** (kăz'-mōs). The cosmos, or **solar system**, includes our Sun and the planets around it.

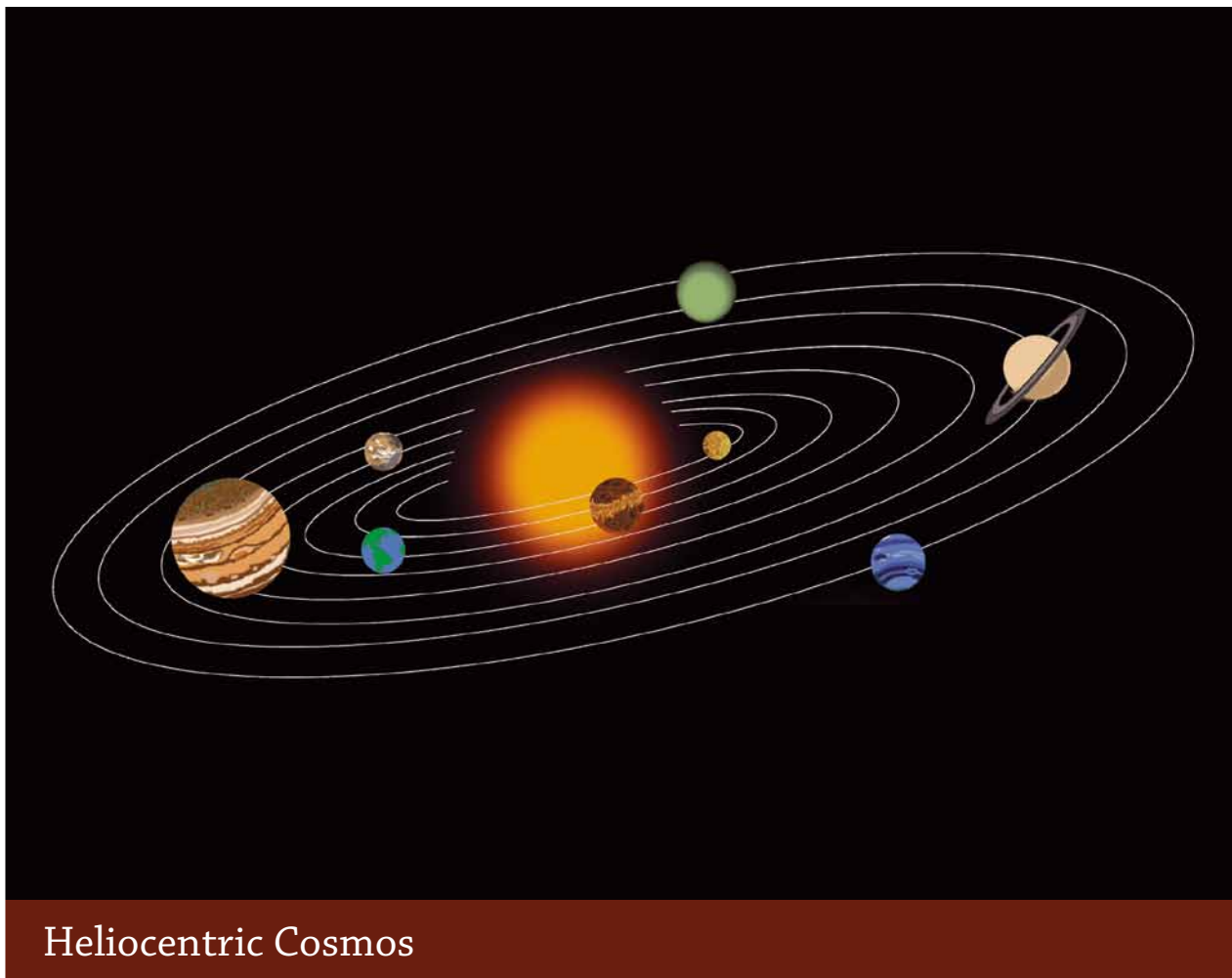
In ancient times most people believed that the Earth was the center of the universe. These ancients believed that the planets and the Sun moved in a circular **orbit**, or path, around the Earth. This view of the world is called **geocentric** (jē-ō-sen'-trik). Geo comes from the Greek word *ge* which means "earth" or "land" and centric comes from the Greek word *kentron* which means "point" or "center." A geocentric view is one that considers the Earth as the true center of the universe.



Geocentric Cosmos

It is not hard to understand why this view was held. Stepping outside at any given time of the day and observing the motion of the Sun, it *looks like* the Sun rotates around the Earth. A geocentric view of the universe was first proposed by **Aristotle** (a'-rə-stä-təl) (384-322 BC [BCE]) and was the dominant belief held by most people for many centuries.

However, not everyone agreed with Aristotle. **Aristarchus of Samos** (a-rə-stär'-kəs of sā'-mäs), who lived from 310-230 BC (BCE), was an expert Greek astronomer and mathematician who did not believe that the Sun and planets revolved around the Earth. He was the first to propose a **heliocentric** (hē-lē-ō-sen'-trik) **cosmos**. The word heliocentric comes from the Greek word *helios* which means "sun." A heliocentric cosmos is a view of the universe with the Sun as the central point and the Earth and planets orbiting the Sun.



Heliocentric Cosmos

Although today we know that Aristarchus was right, his proposal was rejected by his colleagues because it seemed to contradict everyday observation. If the Earth was not stable (central and not moving), how did everything not bolted down keep from flying off the Earth as it rotated around the Sun? The physics of Aristotle was the scientific consensus view during Aristarchus' lifetime and that meant that a heliocentric cosmos would have violated the laws of physics! It was almost 2000 years before the idea of a heliocentric cosmos was reintroduced by **Nicolaus Copernicus** (kō-pər'-ni-kəs) (1473-1543) and confirmed by the scientific observations of Galileo.

Today, astronomers do not believe in a geocentric cosmos and know that our Earth orbits the Sun and that we live in a heliocentric solar system. Modern technologies, a deeper understanding of physics, and a willingness to challenge prevailing scientific theories were needed before the geocentric view could be replaced by the more accurate heliocentric view of the cosmos.

1.5 Summary

- **Astronomy** is the field of science that studies **celestial bodies** and how they exist and move in space.
- Early **astronomers** were able to map the movements of the planets and stars and used celestial motions to create calendars.
- Modern astronomers use **chemistry** and **physics** together with modern technologies to study the universe.
- Ancient peoples once believed in a **geocentric cosmos**, or Earth-centered universe. Today we know that we live in a **heliocentric solar system** with the Sun at the center.