User’s Guide to the Sky: Patterns and Cycles

Introduction

As you look out at the night sky, into the rest of the universe, you are looking through our atmosphere (about 100 km thick).

The space beyond our atmosphere is nearly empty, except for the billions of stars and planets, dust, gasses, comets, asteroids, meteors, which are contained in each of the billions of galaxies.

Even though there are so many objects out there, they are so far apart, and the space between them is so immense, that the space between them is essentially empty.

As we look out into the far reaches of the universe, or anywhere closer, we must remember that our viewing point is also moving, as the Earth rotates on its axis, and rotates around the sun.

These rotations are cyclical, therefore cause the apparent daily “movements” of the heavens, but truly are only caused by our movement.

Stars Chapter 2 Section 1 (pages 10-14)

As you observe the night sky, your view is limited to a few thousand stars that are close enough, big enough, and bright enough for us to see from our vantage point in the galaxy.

Some things you think are stars are actually distant galaxies that are so far away, the light from its billions of stars has converged to a single point of light.

Over time, humans have named stars, measured their relative brightness, and attempted to determine how far away they are, but that is not how observation of the night sky began.

Ancient people and cultures around the world have used the night sky to tell stories of heroes, gods, mythical creatures as part of their culture, religion, folklore, and mythology.

They grouped the stars into constellations and named these constellations to help tell the stories.

**Constellation** – one of the stellar patterns identified by name, usually of mythological gods, people, animals, or objects. Also includes the region of the sky containing that star pattern.

Most constellations do not look exactly like the creature for which they are named. You need to use a bit of imagination, just as the ancients did.

The constellations and names we use now in western culture originated in and have survived from the ancient civilizations in Mesopotamia, Babylon, Egypt, and Greece, from as early as 5000 years ago.

Of all the ancient constellations, about 48 are still in “use” and commonly named.

Some important constellations that you will need to be able to recognize and locate are:

 1. Ursa Major 5. Cassiopeia

 2. Ursa Minor 6. Gemini

 3. Orion 7. Canis Major

 4. Cepheus 8. Hercules

Since the roots of our western culture were generally in the northern hemisphere (northern latitudes), stars visible in only the southern hemisphere were not originally included in any constellations.

Some stars may have been included in more than one constellations, when constellations sometimes overlapped.

“Modern” astronomers have added 40 constellations as cultures have spread across the Earth, and separated overlapping constellations.

In 1928, the International Astronomical Union (IAU) officially established 88 constellations, each with its own stars and section of the sky (region of view).

In addition to the constellations, there are also asterisms, for example: the Big Dipper, which is part of the constellation Ursa Major.

**Asterism** – a named grouping of stars that is not one of the recognized constellations

Although constellations make a picture from our point of view, most of the stars that make up any single constellation, are not physically associated. Meaning they are generally not close to each other, even in the immense distances of space, and may be moving through space in different directions. They simply currently lie along a common direction when viewed from Earth.

# Names of stars

The constellation names come from the ancient Greek and Latin languages used by scientists of the Medieval and Renaissance Europe as translated or simply used from the ancient cultures over time.

Some stars, generally the brighter ones, also have names, given to them by both ancient and modern astronomers.

Star names generally fall into a couple categories:

 1. Derived from ancient Arabic (translated and altered over the centuries)

 🡪 For example: The bright red star in the constellation Orion is named Betelgeuse, is

 translated from the Arabic *yad aljawza*, which means “armpit of Jawza (Orion).

 2. Greek letters (α, β, γ, etc) are used to designate the bright stars in a constellation.

 The alpha (α) being the brightest, the beta (β) star being second brightest, etc.

 Sometimes this version of a name also includes the name of the constellation.

 🡪 Example: Alpha Canis Majoris (brightest star in the Canis Majoris constellation

The Brightness of stars

Astronomers measure the brightness of stars using the magnitude scale.

**Magnitude scale** – The astronomical brightness scale, the larger the number the fainter the star.

Ancient astronomers divided up the stars into one of six brightness groups.

 🡪 First-magnitude = brightest

 🡪 Sixth-magnitude = least bright

 \*The larger the number the fainter the star

Hipparchus (190-120 BCE), a Greek astronomer is credited with compiling the first star catalog, and there is evidence to suggest that he used the magnitude system in his catalog.

Claudius Ptolemy (~140 CE), an Egyptian-Greek astronomer also created a star catalog, and he definitely used the magnitude scale in his catalog.

Star brightnesses are known as apparent visual magnitude (mv)

**Apparent Visual Magnitude (mv)** – A measure of the brightness of a star as seen by human

 eyes on Earth.

Brightness is subjective, and depends upon:

 🡪 The physiology of the eyes

 🡪 The psychology of perception

Flux is a more scientific measurement.

**Flux** – The measure of the light energy from a star that hits one square meter in one second.

Flux is converted back to the mv scale for consistency with charts dating back to the time of Hipparchus

The apparent visual magnitude scale has limitations, so there has been a need to supplement it by:

 1. Extending the scale into the negative number range to accommodate extremely bright stars

 Example: Sirius = -1.47 mv 🡪 the brightest star in the sky

 2. Using telescopes we are able to find stars much fainter than with just the eyes

 🡪 This extends the numbers on the range above the 6th magnitude

 3. Other magnitude systems have been invented to account for infrared and ultraviolet light from

 stars, which are invisible to the human eye, but detectable with other equipment and technology.

 4. The true power of a star has its own scale, which is based on the distance the star is away from

 the Earth.