The Objects That Changed Astronomy

(And How to Observe Them)

-Brad Young, Astronomy Club of Tulsa

Part One: Homo Erectus to Galileo

In my next four articles, I'd like to look at the objects that changed astronomy, their impact, and how we can observe them today and understand how they have educated us about the universe we live in. Mankind's understanding of the universe has grown enormously in the last few centuries but has been improving since long before written history began. Let's begin with the ancient world, and the historical era up until the invention of the telescope. Consider too that many animals respond to the objects below and changes that occur, because they influence their lives and behavior in myriad ways.

Future articles will consider the astronomical growth from the invention of the telescope to the invention of photography, then on to the beginning of modern space-based observatories using the full spectrum of light and instruments of amazing power and scope.

The Sun

The sun also rises, and the sun goes down, and hastens to the place where it arose. Ecclesiastes 1:5

Although this daily cycle seems unremarkable to us today, we should remember that night used to mean terror for our ancient ancestors, especially before the domestication of fire. Having the sun rise was a wonderful thing; it brought heat and light and safety. At some point, people also noticed that it rose in different spots along the horizon, and often this affected the length of the day and night. These fundamental ideas are some of the earliest recorded scientific observations. These observations track the patterns which led to the defining acts of this epoch: the clocking of the seasons to raise crops and livestock. Indeed, the Sun and it's wandering are tied very intimately to mankind's development of civilization.

Famous Ancient Seasonal Observatory and Rock Concert Prop

There are many ways to observe the sun now, including noting is changing position in the sky by charting the shadow it casts throughout the day (sundial) or year (the analemma). Or just watch it rise on a chilly morning or set on a beautiful warm evening. Other ways to observe the sun using instruments (which really expanded our knowledge) will be discussed in later articles.

The Moon

Cold hearted orb that rules the night, removes the colours from our sight.
Red is grey and yellow white, but we decide which is right.
And which is an illusion?

"Late Lament" poem by Graeme Edge

The other major light in the sky, the Moon also shows cycles. Its cycles are both shorter and longer in duration than the sun's. The phases of the moon were probably noticed by the earliest humans, as there is evidence that some animals even notice some and may be influenced in their behavior by then. The tides of course are caused by the moon, and although this was not thoroughly explained until 1687 by Isaac newton, a correlation had been suggested before. And the Saros cycle, which determines when eclipses will occur, had been known to ancient civilizations all over the world.

Observing the Moon in historical context is even easier than the sun. We can observe its phases every night, observe the markings on it even with our eyes alone, and observe eclipses of it by the Earth or of the Sun whenever they are available. There are usually two to five eclipses of some kind visible every year somewhere on Earth; in 2022 there are two solar eclipses, neither of which are seen in North America, and two lunar eclipses, both of which are.

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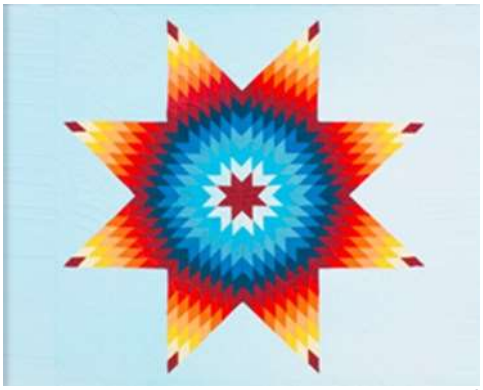
The Stars



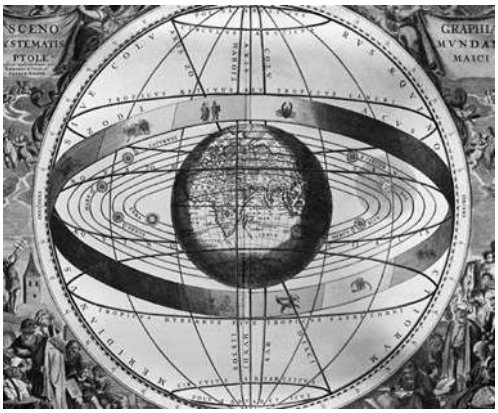
May the stars carry your sadness away, May the flowers fill your heart with beauty,
May hope forever wipe away your tears, And, above all, may silence make you strong.

—Chief Dan George, Tsleil-Waututh

The most ancient civilizations recorded star patterns and myths and legends associated with them. Pattern recognition is a highly important skill used by animals in different ways and recognizing patterns of stars is used by migratory beasts from birds to humans. The intersubjective thought exemplified by the mythology of the stars was a social bonding tool that led humans from marginally subsistent apes to the overlords of the animal kingdom. And these myths passed the technology to track the seasons and support domestication of crops and animals via oral tradition, long before writing was available. In other words, the cognitive revolution, in part manifested by ancient astronomy, led to the agricultural revolution.

But besides their importance, it's just fun to go out to a dark sky and watch the stars. Some of the patterns used by the ancients are a little hard to imagine, but others like Orion, Leo and Scorpio almost look like what they're supposed to be. And you can even make up your own patterns, your own stories as you sit around the campfire and enjoy the night sky. Or explore the stories and patterns developed by other cultures that you may not have heard about. It's a free show available to everyone every clear night.

The Planets



The fault, dear Brutus is not in our stars, but in ourselves, that we are underlings.

Cassius, "Julius Caesar"
(Act 1, Scene 2, verse 140-142) Shakespeare

Five of the stars were seen to move in the sky. Mercury, Venus, Mars, Jupiter, and Saturn were identified as planets in ancient times, and various wanderings led to other discoveries that helped explain how the universe is constructed. It was noticed that they, along with the sun and moon, traveled in a line of star patterns called the zodiac. Some sort of definition of this line by star patterns exists in nearly every culture. And their retrograde motion exasperated observers for centuries until Copernicus explained it by placing the Sun at the center of the solar system instead of the Earth.

The beginnings of modern astronomy were, in fact, astrology. The blurred lines are evident everywhere in history, from Newton to Lowell. Eventually, scientific method led to a schism that allowed astronomy to flourish in its modern form.

Again, even without a telescope, you can observe the planets whenever they are visible. Watch as Mercury pops up from the Sun three times a year in the evening and three times in the morning sky. Watch as Venus pops in and out in a slower cycle, usually appearing in the dawn or the dusk once a year as the brightest thing in the sky besides the Sun and Moon. Watch the stately wanderings of the outer planets

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Saw a Fireball?

Report it to the American Meteor Society!

www.amsmeteors.org/members/fireball/report-a-fireball

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and their retrograde loop as they approach and pass opposition. There are of course a lot more things to see about the planets as we will find in future chapters. But perhaps before you crank the power up on your mega scope to count the number of whorls in the Great Red Spot, it will interest you to just look at the planets as they move through the patterns of stars and imagine how surprising this must have been to early man and how he began to try to understand and explain why they moved while the thousands of other points in the sky stayed still.

Supernova

Someday you will find me caught beneath the landslide in a champagne supernova in the sky

"Champagne Supernova" Noel Gallagher

Although it wasn't exactly understood why, it was noticed that some of the Stars would grow much brighter than usual or appear from nowhere and become bright. These Nova or new stars would then fade usually to obscurity in a few days or weeks. It was generally understood that they had somehow gone through an extreme change, but it was not understood in detail until later in history.

Unfortunately, it would be a bad bet to tell you that you can see a naked eye supernova anytime soon. The last truly spectacular ones occurred just before the invention of the telescope, and we haven't really had one like those since. There are certainly candidates for ones that might go supernova soon, such as Eta Carinae, but there's really no way to tell until it happens. Similarly, I would be a fool to tell you that you will see a naked eye comet, but you never know.

Comets and Meteors

Comets were generally indicators of doom as you may know, but their appearance and motion to the sky made people wonder what they might be. Edmond Halley's brilliant determination that one comet had been seen several times through history was another explanation that came just after the deadline for pre telescopic times, but their importance in the history of astronomy had already been determined.

I'll be with you darling soon; I'll be with you when the stars start falling

"Sunshine of Your Love" Eric Clapton, Jack Bruce, Peter C. Brown, Peter R. Brown

Many attempts were made to explain their motion, sudden appearance, and fuzzy look with ominous tails trailing behind them, but it was mainly a subject of conjecture until Halley.

Meteors were certainly more numerous, but they were also confusing. It seemed as if stars were constantly falling out of the sky, but there never seemed to be fewer of them. On rare occasion, they would even make it to the surface and strike the Earth. But full explanations of both the objects seen in the sky and the objects found on the ground were lacking until more modern times. Meteorites found on Earth were thought to be stones that had been struck by lightning even in Ben Franklin's era. And the discovery of meteors being residue from comets also had to wait until modern times.

Meteors are also a bit unpredictable, but if you look at a dark site, you'll probably see a few any moonless night of the year. And there are several predictable showers that occur such as the Perseids and Geminids that give you a much higher chance of seeing meteors. There's nothing more relaxing than laying back in a lawn chair with a cool drink or a hot cup of cocoa and watching the stars fall.

There are many other astronomy related discoveries that were made before the invention of the telescope, but these may have been the most important ones to inspire wonder and exploration. Hopefully you can take the time to revisit these objects and phenomena and put yourself in their place. With only their eyes and their brains, our ancestors determined our place in the universe, how planets moved why they moved why the moon has phases and how the seasons work. These are the fundamental pillars of astronomy and in some ways of civilization itself.

Next time we will look at the age of discovery between the invention of the telescope and the invention of photography. Quite an amazing time to discuss.