

WONDERS OF THE HEAVENS

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WONDERS OF THE HEAVENS

Since ancient times, mankind has gazed up at the night sky in awe and wonder. While staring out into the expanse of outer space, one cannot help but be struck by the enormity of the cosmos. The beauty of the heavens has inspired many of our greatest dreams and scientific discoveries. It seems only fitting that each new discovery we make about the universe leads us to reinterpret our place in it.

From our vantage point, the sky seems stretched over us like a canvas—a vast celestial painting encircling our world. As romantic as this may seem, the beauty we see often belies the violent nature of the powerful forces of our universe. What may seem like a simple blotch in the night sky could be a phenomenon of unfathomable size and power.

Whether one is observing for scientific, aesthetic, or even religious reasons, one cannot help but be instantly captivated by the wonders of the heavens.



It would be an obvious statement to say that the sun is vitally important to our existence. It provides all of the light and warmth necessary for many of the organic processes on earth. The vital nature of the sun has been felt throughout history, as many myths and legends have been written about its power to bestow life on the earth.

However benevolent and life-giving the sun may appear, its affects can be deadly as well. Its energy comes from nuclear fusion, which is the process of two hydrogen atoms being fused into a single helium atom, releasing radiation in the process. This radiation consists of everything from the harmless colors of the visible spectrum to the deadly ultraviolet rays, x-rays, and gamma rays that can cause damage to living organisms with unprotected exposure.

Believe it or not, it takes about 8 minutes for the light radiated by the sun to reach the earth. That means that every time we have looked at the sun has been something of a brief glimpse into the past.





The splendor of the moon has entranced mankind throughout its history. It's gentle glow is both constant and transient, waxing and waning every month in a regular cycle.

This effect of waxing and waning is created by the fact that the moon orbits the earth. Since the moon gets its light from the sun, it reflects more or less light to us depending on its orientation to the earth.

The moon is in a permanent tidal lock with the earth, thus allowing us to only see one side of it from the ground. We simply see more or less of it. It wasn't until the space age that man was finally able to see the dark side of the moon.

The moon is about a quarter of a million miles from the earth, about one-fourth its diameter, and has gravitational pull of about one sixth that of earth. Even with its relatively small mass, it still manages to affect life here on earth. Without the presence of the moon, we wouldn't have any ocean tides.

As mankind catalogued the stars and charted the night sky, something quite peculiar became apparent. Although most of the stars remain in fixed positions relative to each other as they moved across the celestial canopy, there were some objects that moved in bizarre ways. Astronomers became absorbed in trying to predict and understand the movement of these strange objects. What were they, and why did they move across the sky so quickly while all the other stars stood still?

It was only later that mankind realized the source of the planets' bizarre motions: their orbits around the sun. Equally shocking was the revolutionary notion that the earth itself was a planet, moving around the sun in much the circular motion.

Of the eight planets in the solar system, there are two basic types: the rocky inner planets and the gaseous outer ones. While the inner planets have solid rocky surfaces much like our earth, the outer planets consist almost entirely of gas.



SATURN



JUPITER



MARS

OTHER SOLAR SYSTEM OBJECTS

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With mankind's increasing knowledge of the precise motions of the sky, objects were revealed that had even more erratic movements than those of the planets. These strange objects would appear suddenly at times in history and then not reappear for decades or even hundreds of years. To the ancients, these were omens that predicted fateful events. Today we know them as asteroids and comets.

Asteroids originate from the Asteroid Belt between Mars and Jupiter, whereas most comets come from cometary clouds at the edge of our solar system. Though the majority of these small objects remain safely within their respective regions, periodic collisions and gravitational effects have forced some into highly eccentric orbits around the sun. Some of these objects have maintained stable-yet-far-reaching orbits for hundreds, or even thousands of years, but every once in a while one collides with one of the planets, often with dramatic results.

COMET 17/P HOLMÉS



THE STARS

Since time in memoriam, the stars have stared down at us during the long hours of the night. At times, their light has beckoned us to ponder the very nature of our universe. Where did the stars come from? What are they made of? Are there any other worlds out there? These questions and more have left indelible marks upon our collective hearts, minds, and souls.

To our ancestors, the stars represented the epitome of constancy in creation. While so much on earth seemed transient, the stars flowed in a predictable, seemingly eternal cycle. Their movements and positions coincided with the flow of seasons. They could be used to indicate times for planting crops, harvesting, and the like. It would not be a stretch to say that the night sky was man's first calendar.



THE MILKY WAY

The vast expanse of stars we see is in fact a myriad of suns, each varying in size and intensity. While some stars are much smaller than our sun, others are large enough to swallow it several times over. They also give off a variety of colors depending on their temperature. Much like fire on earth, relatively cool stars give off mostly red light, whereas hotter stars give off shades of blue.

Although visiting the stars is an enthralling notion, it would require significantly greater technology than what we have today. Even traveling at the speed of light, it would take about four years to reach the nearest star. If we could ever visit other worlds among the stars, it would require nothing less than a total revolution in the very science of traveling through not simply outer space, but space itself.

CLUSTERS AND CONSTELLATIONS

If you can look up at the night sky, you will undoubtedly be able to see a diverse arrangement of shapes and patterns in the stars. From these points of light, you may be able to imagine the outlines of concrete images. These images are what we know as star clusters or constellations.

While the light pollution from modern-day cities makes viewing most stars at night a little bit difficult, you can most likely see at least one of the more prominent star clusters or constellations with your naked eye. Among these might be such familiar sights as the Pleiades (pictured at left), and Orion the Hunter (pictured at right).

To our ancestors, these stellar arrangements made up a vast story-telling framework of epic struggles and mythic figures. The constellations took the shape of mighty heroes, mythic beasts, horrible monsters, and damsels in distress. From these they constructed epic stories of good and evil, life and death, love and loss, and many of the other

THE PLEIADES (THE SEVEN SISTERS)

enduring themes of the human condition. To put it in a poetic way, mankind took its imagination and collective cultural experiences and used them to personify the sky.

Which particular set of constellations or clusters you see in the night sky is dependent upon the time of year, as well as your place on the planet earth. For instance, the night sky of the southern hemisphere has a completely different set of constellations than that of the northern sky.

In a way, one's position and perspective is everything when it comes to seeing constellations. The features of the night sky we see are completely dependent upon our planet's position in the universe. It would be hard for us to imagine, but if the earth were at the other end of the galaxy, our constellations would be entirely different. One can only wonder exactly what kinds of images we might see if that were the case. Who knows what great stories we might devise to embody them?



The Zodiac is a specific circular arrangement of constellations running across the entirety of the night sky. As the stars move across the night sky, so do the signs of the Zodiac.

Needless to say, the Zodiac holds a special place in the realm of human history and imagination. For years they've been used for everything from trying to tell the future to determining a couple's compatibility in romance. There are twelve signs in the Zodiac, each one ascribed to a period of roughly a month long. In the past, the Zodiac sign one was born under was crucial to determining the course of the rest of their life. However, most people in more modern times wouldn't consider the Zodiac to be much more than a passing curiosity.

No matter which side of the fence one is on in terms of the astrology aspect, the Zodiac constellations can definitely be appreciated for their beauty alone. They are yet another set of beautiful features in the glorious tapestry of the heavens.



SCORPIUS THE SCORPION



As mankind's view of the universe expanded ever further into the depths of the cosmos, we began to see curious groupings of stars far away in the deep outer reaches of space. These arrangements had a variety of shapes; everything from flattened disks to elliptical blobs to spirals with long, outstretched arms. Also, we realized that our sun was one of many stars in such a grouping. These collective objects are known as galaxies.

All of the stars in a galaxy move around a common center of gravity. Most likely this is caused by the presence of a supermassive black hole at the center of the galaxy.

Not only do the stars within a galaxy move, but the galaxies themselves move as well. At times entire galaxies crash into each other violently, reshaping both galaxies in the process. While these collisions are powerful, sending stars flying out into the cold expanse of space, they do not happen very often. Even when two galaxies meet, it can take several eons for the collision to fully end.



THE ANDROMEDA GALAXY



THE WHIRLPOOL GALAXY (COLLIDING WITH ANOTHER GALAXY)

NEBULAE

If there are any features of the night sky that most closely resemble the work of an artist, they would be the nebulae. Their vibrant, dazzling colors resemble the brushstrokes of a skilled painter, painting across the tapestry of sky with reckless abandon. Without nebulae, our view of the night sky would be limited to the joining of the simple points of light from stars, galaxies, and constellations. In aesthetic terms, one might say that the nebulae provide a colorful layer of texture and warmth to the great cosmic canvas.

In many ways, nebulae represent the epitome of tragic beauty in our universe. The most common source of nebulae is from the ejection of a star's outer gas layers, either from a nova or from the star's violent death. There are many ways in which a star can die depending on its mass, but the expulsion of gas is almost a universal constant to a star's death. Probably the most well known of these stellar explosions is a supernova; an explosion powerful enough to eradicate an entire solar system.

THE ORION NEBULA

What remains at the center after such an event is little more than a dried up husk of the star's former glory, such as a white dwarf or a neutron star. A sufficiently massive star will collapse upon itself and form a black hole, voraciously devouring all matter in its vicinity. In such a case as that, even the nebula may not last for very long.

Even though nebulae are intrinsically linked to the death of stars, they can also bring about new stellar life as well. In a way, nebulae serve as vast stellar nurseries, since the stray hydrogen gas from the dust cloud can condense and form new stars.

Left to it's own devices, our own sun will one day suffer such a fate as well. Although it has been burning for a very long time, its supply of fuel is not infinite. One day it will run out of hydrogen to fuse into helium, will expand greatly in size, and then eventually run out of helium to fuse into carbon. After this supply has run out, the sun will go supernova, perhaps creating its own nebula in the process.



THE EAGLE NEBULA



HORSEHEAD AND FLAME NEBULAE

As we can clearly see, the universe is filled with amazing wonders. The more we observe it, the more startling images and phenomena we see. By looking up at the skies, we have discovered new suns, new worlds, and new forces beyond our comprehension. Any time that we lose sight of ourselves, we can always stare up at the sky and be reminded of our place in the ebb and flow of the universe.

Even though our ancestors' notions of the universe were quite imaginative, the truth behind the workings of these objects and processes has turned out to be more amazing than we could have ever imagined. However, that is not to say that our imagination is without worth, as it is the human spirit that is the spark of scientific discovery. As long as we draw breath, we will continue in our quest for knowledge. The insatiable curiosity in our souls has brought us to our current understanding of the workings of the cosmos and will continue to drive us to unravel more and more wonders of the heavens.

THE TRIFID NEBULA

NORTH AMERICAN AND PELICAN NEBULAE

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