Since the beginning of history, man has observed and tried to understand the movements of the sun, the moon and the stars. Around the world we have evidence of their efforts and continue to build on what they learned.

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The Ancients Observed

People of ancient civilizations all around the world would gaze up at the heavens, their sight always limited by the darkness of night. But what did they see? Their eyes were filled with wonder and curiosity, and they sought to understand the patterns they observed. They built observatories and conducted scientific activities to learn more about the celestial bodies and the phenomena that govern them. In this section, we will explore how the ancients observed the heavens and the astronomical knowledge they gained.

Astronomy of Ancient Stonehenge

Stonehenge is undoubtedly the most famous astronomically aligned structure in the world. Located in the county of Wiltshire, England, Stonehenge is a complex of circular earthworks and standing stones that were erected over a period of approximately 1,500 years, from 3100 BCE to 1600 BCE. The site is situated on the eastern edge of Salisbury Plain, and it is one of the most significant prehistoric monuments in Europe.

The builders of Stonehenge believed that it was a place of great spiritual significance, and they aligned the structure with the movements of the Sun and Moon. The monument is thought to have been used for various astronomical activities, including solstice and equinox observances, as well as the tracking of lunar cycles and the prediction of eclipses.

Stonehenge is composed of a series of concentric circles, with a central stone circle surrounded by a larger outer circle. The outer circle is made up of 30 stones, and the central circle is made up of 20 stones. The stones are arranged in a way that creates a larger circle of 385 feet in diameter, which is aligned with the Summer Solstice sunrise.

The Sun and Moon were important celestial bodies for the ancient people of Stonehenge, and they used the monument as a way to track their movements. They observed the Sun rising and setting at specific times of the year, and they used this information to mark the passage of time and to track the seasons.

Stonehenge is a remarkable example of the ancient people's knowledge of astronomy and their ability to use it to understand the natural world. It is a testament to the ingenuity and skill of these early astronomers, and it continues to inspire and educate us today.

Mysteries of Chaco Canyon and the Western U.S.

Chaco Canyon is a large archeological site located in the American Southwest, in what is now part of the U.S. state of New Mexico. It is known for its impressive Great House complexes, which were built by the Ancestral Puebloans between 850 and 1150 CE. The site is located on the banks of the Chaco Wash, a tributary of the Pecos River.

Chaco Canyon was a center of political and religious power for the Ancestral Puebloans, and it is believed that the site was used for ceremonial purposes and as a hub for trade and communication. The Great Houses were constructed using adobe bricks and were surrounded by kivas, which were ceremonial chambers.

The site is also known for its alignment with the Sun and Moon, and it is believed that the Ancestral Puebloans used the site for astronomical observations and calculations. The site's buildings were aligned with the positions of the Sun and Moon at specific times of the year, and this alignment was used to mark the passage of time and to track the seasons.

Modern Observatories

Modern scientists continue to use observatories to observe the Sun and its effects on Earth. Over the years, scientists have built on the knowledge gained from ancient observatories, and they have developed new technologies to observe the Sun in ways that were never possible before.

Modern observatories are equipped with advanced telescopes and other instruments that allow scientists to observe the Sun in ultraviolet light, to measure its magnetic field, and to track sunspots. Scientists use this information to better understand the Sun's behavior and to predict solar flares and other space weather events.

Astronomy and Space Weather

Today, we know that the Sun is a star that is similar to the Sun, and it is the source of the energy that powers the Earth's atmosphere and climate. The Sun is also the source of many space weather events, such as solar flares and coronal mass ejections, which can affect the Earth's magnetosphere and cause disruptions to technology and communication systems.

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The Sun is a vital source of energy for life on Earth, and it is essential to the functioning of our planet. Scientists continue to study the Sun and its interactions with the Earth to better understand the natural world and to predict space weather events that could affect our lives.
What the Ancients Observed

People of ancient civilizations all around the world would look up at the skies, their eyes always latched by the distant horizons, and wonder at the moon, the sun, and the stars as they wheeled across their skies. The great expanse of the unknown spread before them in a great dome. They built sky objects to study these wonders of nature. In the Chacoan cities, massive masonry was piled up in great mesas, and huge stones were set in place on the earth's horizon to mark the most prominent celestial objects. Modern archaeologists are drawing these same alignments to help them understand the peoples' fascination with the sky.

In some of the Anasazi ruins, large rock walls and stone circles were aligned with the stars and sun. Thanks to modern satellite imagery and computer programs, it is now possible to locate these alignments, which were known to the Anasazi as the “Village of the Clouds” or “The Mysteries of Chaco Canyon.”

Stonehenge is probably the most famous astronomically aligned structure in the world. Although there are only 10,000 stone circles in Great Britain alone. For over 3,000 years beginning in 2500 B.C., generations of druids dragged huge stones weighing 20 to 40 tons or more to build and maintain the site. The stones were arranged in a large circle with marker posts and a path radiating out from this central structure. In the 18th century William Stukeley had noticed that the inner horseshoe shape of stones faced in the direction of the midsummer sun. It was reasoned that the monument must have been deliberately planned so that on midsummer’s day the Sun’s rays shine onto the center of the monument. Thus the stone circle was constructed as a template for the Sun’s rays shining on the central area and terrace.

Stoneshenge probably was not an ancient or medieval altar to the Sun, nor was it a temple to the Moon or the Sun. It was intended to be a calendar, like a watch or clock, not a temple, to record the path of the Sun through the sky. Astronomers believe that Stonehenge was a calendar to record the path of the Sun through the sky. Astronomers believe that Stonehenge was a calendar to record the path of the Sun through the sky.
People of ancient civilizations all around the world would look up at the heavens, their eyes always stimulated by the distant horizon, and wonder at the moon, the Sun, and the stars as they wheeled across their skies. The great use of the unknown spread above them in a great dome. They built sky temples to look up into these skies, so to make order of it, so to understand it. Many cultures made gods of the Sun and stars and ascribed them natural features, such as the Sun’s disc shaped like the sky. They followed it to and depended on these markers of time and change much more than we do today.

Across a wide variety of cultures and locations, we find an impressive record and gradual and subtle development of the Mouseton. Why did they do it? One practical reason they needed some kind of calendar to know when to plant their crops, when it would usually rain in the area, or when certain star patterns should cause some fear. Timekeeping in the Sun and stars were closely tied in timing and the changes of the seasons, often marked by movements of the Sun and stars.

As they began to record these observances, some cultures developed a unique and accurate understanding of astronomical knowledge. They developed calendars based on their long-term observations. The Mayans are perhaps the most famous example of this. They believed the universe was divided into four basic directions and each direction was marked with the signs of the zodiac.

In the second millennium B.C., the ancient Mesopotamians developed a calendar based on the movements of the Moon and the stars, and by the beginning of the first millennium B.C., the number of years in a century had been accurately calculated. This knowledge of the Sun and stars was fundamental to the design and placement of Stonehenge.

The builders of Stonehenge must have had a sophisticated astronomical knowledge of the path of the Sun and the Moon. The alignment between the Winter and Summer solstices was a particular location very important so important that stone circles and horned arrangements were constructed to mark it and so that the very large earthworks were housed from a great distance away. The famous stone circle and horned arrangement was added later to the monument and are not essential to the solar and lunar observatories.

Holes placed at precisely regular intervals around a concentric circle of about 285 feet in diameter served as fixed reference points and their number was essential to astronomical calculations. Some who have studied these stones believe that various alignments could have been used in making observations of many kinds of the Moon and Sun. Other suggestions suggest that it might have been possible that these holes were used to learn where the path of the Moon and the Sun would intersect and create arclines. Discrepancies continue to exist.

In a number of cases, building phases have led to the problem of what these possible alignments meant and how precisely the builders of Stonehenge understood the movements of the Sun and moon, but all agree that the site was used to express their interest in the sky.


Astronomy of Ancient Stonehenge: Stonehenge is probably the most famous astronomically aligned structure in the world, with its 14,000 stone circles located in Britain alone. Over 3,000 years ago, Stonehenge was a religious site for the people of Britain. The site was likely used for religious ceremonies and was also used as a solar observatory.

Stonehenge is a complex of circles and rings, with a central stone circle, the Aubrey holes, and a outer circle of stones. The site was built in three main phases, each of which included the addition of new stones.

The first phase, called the Aubrey Holes phase, dates back to around 3000 BC and is characterized by a circle of 56 Aubrey holes, which were likely used for astronomical observations.

The second phase, called the Sarsen phase, dates back to around 2400 BC and is characterized by the addition of the sarsen rings, which include the bluestones and the trilithons.

The third phase, called the Woodhenge phase, dates back to around 1500 BC and is characterized by the addition of the wooden circle, which includes the trilithons.

The site was likely used for various astronomical observations, such as tracking the movements of the Sun and the Moon, and may have served as a center for religious and cultural activities.

Stonehenge has been studied extensively by archaeologists and astronomers, and its precise purpose is still a matter of debate. However, it is clear that the site was an important and enduring monument, and it continues to be a source of fascination and inspiration today.
The Ancients Observed

People of ancient civilizations all around the world would use the sky as a reference point to determine the times of day and night, the seasons, and the passage of time. They built structures that align with the movements of the Sun, Moon, and stars, and these structures serve as fascinating examples of the advance knowledge of the ancients with regard to astronomical phenomena.

Astronomy of Ancient Stonehenge

Stonehenge is probably the most famous astronomically aligned structure in the world; there are over 1,000 stone circles in Great Britain alone. Over 3,000 years ago it was a 300-meter, 5-meter-thick ring of large stones in Wiltshire, England. The stones were arranged in a large circle with marker posts and a path radiating from this central axis. The 14th century William Stukeley had noticed that the inner horseshoe-shaped ring of stones faced in the direction of the midsummer solstice. It was reasoned that the monument must have been deliberately planned so that on midsummer's solstice morning, the sun's first rays shine into the center of the monument between the open arms of the horseshoe arrangement.

Modern Observatories

The Haleakula Observatory on Maui is one of the most advanced ground-based observatories, providing an array of instruments to astronomers from around the world. It is equipped with the 1.3-meter W. M. Keck Observatory Telescope, the twin 10-meter Keck Telescopes, the Gemini North and South Telescopes, and the Subaru Telescope. These observatories are critical for advancing our understanding of the universe and its evolution.

Hands-On Exercise: Finding Solar North

Context: A compass was the Earth’s magnetic field to find north and therefore points toward magnetic north, which is not in the same place as geographic north. A shadow plot can help you estimate the true north path by knowing the direction in which the shadow plot is set.

Materials: Sunset stick (example: 3 ft), piece of cardboard, 3-D glasses

Procedure:

1. Face the sunset stick so that it is standing up vertically, when the horizon is directly ahead.
2. Place the piece of cardboard at a right angle to the sunset stick, using the shadows to help determine the direction of true north.
3. Repeat steps 1 and 2 for several days to get an average true north reading.

Output: Students work in groups of 3 or 4.

Activity: The shadow plot is a traditional tool for determining true north by using the shadow of a vertical stick. The circle is divided into 360 degrees, with true north being the direction where the shadow plot is set.

Directions: Use a compass to check the accuracy of your shadow plot.

Results: The shadow plot can be used to determine true north with a high degree of accuracy.

Conclusion: The shadow plot is a simple and effective method for determining true north.
Nowhere is the sense of mystery more profound than on rock face high up on a rock formation where the sunlight, passing between three large vertical rock slabs, marks the solstices as well as the equinoxes (see right). Priests or other officials must have observed these wonders around the world and a significant number of them were aligned appropriately to create a calendar or to predict some of the movements. Why did they do this? One practical reason they needed some kind of calendar to know when to plant their crops, when a river would usually flood in a flood plain, or when certain phenomena should cease. Another reason was that spiritual leaders and officials were closely in touch with the changes of the seasons, often marked by movements of the Sun and stars. As they began to record these observations, some cultures developed a new understanding of astronomical knowledge. They developed calendars based on their long-term observations. The Mayans were particularly adept at calculating the cycle of the moon with amazing precision. For them, this knowledge began to play a part in the design of their living areas and in the construction of their temple areas. In many cases, the main entrance of temple areas occurred on or near solstices or equinoxes.

The Modern Observatories

Today scientists rely on ground-based observatories and spacecraft around the world and a significant number of them are used to observe the movements of the Sun and stars. Over the years scientists have built on the knowledge obtained from earth-based observatories to create new instruments for the observation of space. The creation of new instruments has allowed modern astronomers to gather new information about the universe that could not have been imagined a hundred years ago. For example, many of the first observatories were built in the early 1600s. We have fairly good records of their number, location, and dates of construction. Modern observatories are now able to observe the Sun with much greater precision and to predict changes in the Sun's activity that might affect the Earth. Ancient Chinese astronomers also kept track of naked-eye sunspots for several centuries and were able to predict solar eclipses. 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Nowhere is the sense of mystery more profound than in the ruins of Chaco Canyon, New Mexico. Built over a thousand years ago by the Ancestral Puebloans, these stones were skillfully placed and aligned. The largest of these was Pueblo Bonito, thought to house several thousand people. The size of this complex, and many others like it, defied any understanding of astronomical knowledge. The builders developed calendars based on their long-term studies of the Sun. The mystery remains as to how they were able to achieve such accuracy.

As the largest city of its kind in the American Southwest, Chaco Canyon was a hub of activity. The city was surrounded by circular structures called kivas, built into the ground with benches, a roof, and a central fire pit. The largest kiva was 64 feet in diameter. The kivas were aligned with the stars and sun, and may have represented supernatural forces and the circular dome of the sky. A tremendous amount of effort went into the planning and construction of Chaco Canyon.

To the Ancestral Puebloans, the Sun was a major force in their lives. They watched the movements of the Sun to guide their activities, such as planting crops and observing the seasons. The Sun was also a focus of their religious beliefs and ceremonies. The kivas were used for religious rituals and social gatherings.

Modern Observatories

Like our ancestors from other cultures over thousands of years, modern scientists still cast their eyes up to the skies in the hopes of learning more about the Sun, moon, planets and stars. Although the ancient peoples lacked the modern telescopes and instruments, they were able to observe and record the movements of the Sun, moon, and stars. They used this information to guide their activities and to create calendars.

Stoneshenge is probably the most famous astronomically aligned structure in the world, with over 1,000 stone circles in the British Isles alone. Over 3,000 years ago, in 4000 BC, a group of people from what is now western France built Stonehenge to mark the position of the Sun and planets. The circle of stones was aligned along the axis of the solstice sunrise and sunset, and was used to observe the position of the Sun as it moved across the sky.

Stonehenge is considered to be one of the greatest and most mysterious of all ancient astronomical observatories. It is a site of unparalleled natural beauty and has been designated as a UNESCO World Heritage Site. The stones are made of a variety of materials, including sandstone, flint, and limestone, and are thought to have been transported from as far away as 150 miles.

To the builders of Stonehenge, the Sun was a fundamental aspect of their religious and social lives. They believed that the Sun was the source of life and the provider of food, and that it was necessary to observe and understand its movements. The builders of Stonehenge used a variety of methods to observe the Sun, including the use of wooden sticks and the observation of the Sun's path across the sky.

The builders of Stonehenge built the monument in a series of stages over a period of 1,500 years, starting around 3000 BC and ending around 1200 BC. The monument was originally built as a circle of stones, with a stone causeway leading to a stone circle called the “Heel Stone.” Over time, the monument was expanded and modified, with the addition of large stones and the creation of various alignments.

The Sun is the primary source of light and energy for the Earth, and its movements have been fundamental to the design and placement of Stonehenge. The builders of Stonehenge must have had some knowledge of the movements of the Sun, and likely used this knowledge to determine the optimal location of the monument. The monument was likely built to observe the movements of the Sun and the stars, and to create a calendar to guide the activities of the community.

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What the Ancients Observed

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Across a wide variety of cultures, the ancients observed and recorded and gradually passed on some of the most simple and enduring truths. Why did they do this? One practical reason they needed some kind of calendar to know when to plant their crops, when a flood was likely, or if some important seasonal changes should occur. It is not only the actual date of the change that was important, but the qualities of the change. This is one reason why culture and change were closely tied and influencing the changes of the season, often marked by movements of the Sun and stars.

As they began to record these observations, some cultures developed quite an accurately of astronomical knowledge. They developed calendars based on their long-term observations. The Mayans, perhaps the most accurate, were able to calculate the cycles of the moon with exacting precision. For instance, this knowledge began to play a part in their calendar. By the time they constructed the pyramid that is known as the Pyramid of the Sun, they had a calendar that was accurate to within about 0.004 degrees of the equinox.

Astronomy of Ancient Stonehenge

Stonehenge is probably the most famous astronomically aligned structure in the world. There are about 10,000 stone circles in Britain alone. For over 5,000 years beginning in 3000 B.C., generations of people built and rebuilt huge stone circles located in 20 to 100 miles across and at some points, in the stones to be arranged in a circular or square pattern. It is a fascinating fact that Stonehenge was the largest and most complex of these stone circles. It is not only the size of the stones that is amazing, but the accuracy of their alignment. Stonehenge was probably the best example of the science of the ancient world.

As they began to record these observations, some cultures developed quite an accurately of astronomical knowledge. They developed calendars based on their long-term observations. The Mayans, perhaps the most accurate, were able to calculate the cycles of the moon with exacting precision. For instance, this knowledge began to play a part in their calendar. By the time they constructed the pyramid that is known as the Pyramid of the Sun, they had a calendar that was accurate to within about 0.004 degrees of the equinox.

Modern Observatories

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