



Native American Medicine Wheels



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Native American Medicine Wheels



What are Medicine Wheels?

Ancient and Mysterious Structures

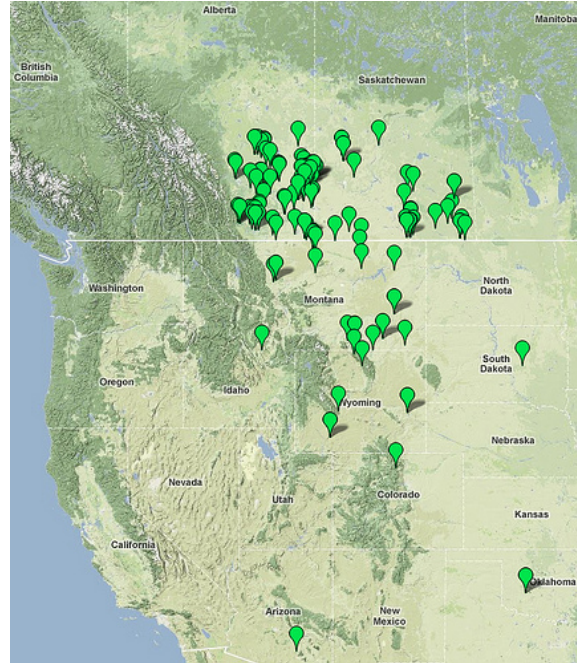
Nearly every ancient civilization has studied the night sky, whether for navigation, measuring time, or spiritual purposes. The Plains Indians of North America were no exception. Dotted the high hills of the northern plains are hundreds of Native American stone constructions, called medicine wheels. Many of these are precisely aligned with the Sun and stars. The name Medicine Wheel may seem strange, considering how modern society thinks of medicine. To the Native Americans, *medicine* means “spiritual and mysterious”. These wheels are an intricate part of their spirituality and connection to the Earth and sky.

There are tens of thousands of stone circles that freckle the landscape of Canada and Northwestern United States. The majority of these circles are tipi rings, stones arranged

to hold down the sides of a tipi. So what makes the medicine wheels unique and special, and is there a way to distinguish them? This answer is yes! Many medicine wheels have been found although few of them have been studied. The medicine wheels that have been documented all seem to share at least two of these distinct traits:

- They have a central stone cairn (large pile of rocks)
- They consist of one or more concentric stone circles
- They include spokes of stones radiating outward from a central point

Although all medicine wheels typically share some of these traits, they can be very different from one another in overall design. There are different types of wheels with different styles of construction. Some look like wagon wheels, some look like bull's-eyes, and others are more abstract. There are only a few hundred large medicine wheels left. They are fragile sites, most protected only by keeping their exact locations secret.



Who built the Great Medicine Wheels?

The Medicine Wheels in North America were built by the ancient Plains Indians, nomadic tribes including the Sioux (Lakota, Dakota, Nakota), Cheyenne, Crow, Blackfoot, Arapaho, Cree, Shoshoni, Comanche, and Pawnee. Because they followed herds of buffalo and deer, they were typically on the move most of the year. At one time the Plains Indians occupied all of central North America, from the North Saskatchewan River in Canada, to Texas, and from the valleys of the Mississippi and the Missouri to the foot of the Rockies.

Since they rarely stayed in one place, these nomads did not need to build permanent structures out of stone. Thus architectural evidence of the ancient plains Indians is almost non-existent. Along with the lack of permanent buildings, they did not have a written



language. Their knowledge and lore were passed down in stories told through generations.

Even though they left no books to guide us, much of their story can be gleaned in their art and artifacts. Many of these objects reflect their fascination and respect for the Sun and sky. They looked at the heavens with wonder and awe just as we continue to do today. It appears these ancient Plains Indians were deeply connected to their environment and their mythology is rich with celestial themes.



When were the Medicine Wheels built?

Medicine Wheels vary in age by centuries. The current Bighorn Medicine Wheel in Wyoming is thought to be about 800 years old, thus still fairly "new." However, there is some evidence that the wheel existed for much longer than that, and that the current wheel is only the last instantiation of a wheel at Bighorn. The Moose Mountain wheel in Saskatchewan is thought to be about 2000 years old, thus built around the time of Christ. Moose Mountain is so similar to Bighorn that some believe it was the model for the younger wheel. The oldest wheel known is in Majorville Canada. Archaeologists have set its age at 5000 years, around the time of the great pyramids of Egypt. There is evidence that some of the older wheels have been adjusted over the centuries to correct for the shift in alignment of the solstices.

Image credits:

- Initial Medicine wheel: bigweasel through a Creative Commons license
- Map medicine wheel sites http://www.gleanr.com/gleans/29716_medicine_wheel_faq
- Plains Indians with teepee <https://nwsisdsrc.wordpress.com/plains-indians/>
- Chaco Canyon pictographs photo courtesy Deborah Scherrer

What Purpose Do Medicine Wheels Serve?

Though there are hundreds of medicine wheels in North America, mostly in Canada, only a small percentage have been studied. In that small percentage, an interesting correspondence has been discovered: most of these wheels have a cairn, or central pile of stones, and markers surrounding the cairn that could be used to align, or point to, the sunrise at summer solstice. Could this be a coincidence, or an important step in unraveling their mysteries?

The more elaborate constructs of the Bighorn, Moose Mountain, and the Majorville medicine wheels have become the center of the studies of astronomers and archaeologists alike. What makes these wheels so unique is that they are thought to be aligned to objects in the sky, especially the Sun, Moon, and certain key stars.

Solar and Stellar Alignments

Astronomer John Eddy¹ became intrigued by the cairns of the Bighorn Medicine Wheel in the 1970s. He discovered that one pair of cairns was aligned to solstice sunrise and another to solstice sunset. But he could find no answer for the existence of the other cairns. They seemed to have a purpose since they were so prominent. What could it be?



Bighorn Medicine Wheel Summer Solstice Sunset. Note the alignment.

¹ Eddy, John A, "Astronomical Alignments of the Bighorn Medicine Wheel," *Science* 184(4141):1035-1043; 1974.

Dr. Eddy began his search with the sunrises and sunsets of other important dates, such as winter solstice and the equinoxes but found no correlations. Not easily deterred, he checked for alignments to the Moon and stars. The paths and cycles of the Moon lead to nothing substantial. However, in the stars he found an intriguing correlation. Because of the Bighorn wheel's location, on top of a high and windy mountain, the wheel is only accessible for about two months in mid summer. The rest of the year the wind-swept plateau is covered in snow and freezing cold. Eddy needed a starting point so he began looking for stars that were in the sky in the months before and after summer solstice, when the mountain was accessible.

What he found were alignments to three stars during their heliacal risings. Helical (dawn) risings occur when a star has been behind the Sun for a season, but is just returning to visibility (more on this later). There is one morning when the star "blinks" on before the sunrise, after not having been seen for months. That one special morning is called the star's heliacal rising. Not all stars have heliacal risings because some stars remain above the horizon all the time. Only certain stars rise and flash into existence in the predawn glow of the horizon. Each day that passes after the heliacal rising, the star will appear to rise earlier and remain in the sky longer until its soft glow is obliterated by the rising Sun. Because these helical risings were so specific, just one day, they were used by many different ancient civilizations to mark specific events such as the drought season and planting time. It is not surprising that the Plains Indians would use heliacal risings to signal the coming and going of the solstice.

Eddy found that three major cairn-pairs had corresponding heliacal rising alignments to Aldeberan, Rigel, and Sirius, three of the brightest stars in the sky. A later researcher found a cairn alignment for Fomalhaut, another very bright star. These alignments all occur from standing and sighting at one specific cairn.

The heliacal rising of Aldeberan signals the coming of the summer solstice in just a couple days. Rigel rises almost exactly one lunar month (28 days) after Aldeberan and Sirius one month after Rigel. This could account for Bighorn's 28 spokes. The rising of Sirius could be the signal to pack up and leave Bighorn because the weather was going to take a severe turn. The alignment of Fomalhaut occurs 28 days before the solstice. Perhaps serving as a warning that solstice is near.

What else might the wheels have been used for?

There are many different ideas about the origins of the wheels and the reasons they were built. One of the most exciting connections to the wheels is the [Plains Indian Sun Dance](#). For many of the Plains Indians, including the Lakota, the [Sundance](#) or [Wiwanyag Wachipi](#) was their major communal religious ceremony. Generally held in the late spring or early summer, the rite celebrates renewal, spiritual rebirth, and regeneration of the living Earth with all its components. The ritual involves staring at the Sun while dancing, personal sacrifice, and supplication to insure harmony between all living things. There is a symbolic role played by animals in the Sundance as well. Contemporary Native Americans continue the Sundance today ([the modern Sundance Ceremony](#)).

Some researchers believe that Bighorn closely resembles a Medicine Lodge or Sun Lodge. These structures were built out of wood by the Plains Indians for their sacred Sundance ceremony. This supposition is supported by the lack of timber in the area where Bighorn was built. Stone would have been a more abundant building material than wood. However, this correspondence does not fit with all medicine wheels since Bighorn is one of the few wheels that resemble the shape of the lodge.



The heliacal alignments on the Bighorn wheel could be as simply as signifying the times of year when the weather is suitable for being on the mountain. The rising of Sirius would have been the signal to pack up and leave before the winter weather set in.

We do know that wheels had many different uses and those uses changed over the years from tribe to tribe. Some of them were used as burial mounds, or created to mark a special day in history. Some of them point not only to the Sun but other medicine wheels or natural resources. There seems to be evidence that some of the wheels were updated over the centuries to track the slight changes in solar and stellar alignments.

Image credits:

- Medicine Wheesolstice sunset photograph by Tom Melham. Used with permission.
 - 1886 engraving showing Cree Indians performing a Sundance
-

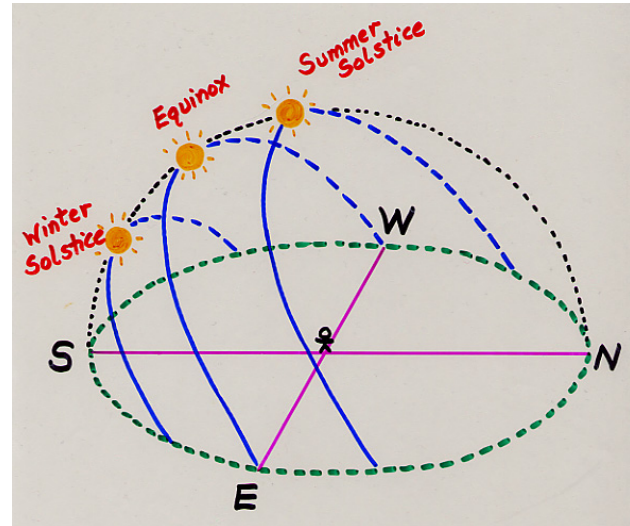
Astronomical Alignments

Where Does the Sun Rise and Set?

Most people know that the Sun "rises in the east and sets in the west". However, most people don't realize that is a generalization. Actually, the Sun only rises due east and sets due west on 2 days of the year -- the spring and fall (observed²) equinoxes! On other days, the Sun rises either north or south of "due east" and sets north or south of "due west."

Each day the rising and setting points change slightly. At the summer solstice, the Sun rises as far to the northeast as it ever does, and sets as far to the northwest. Every day after that, the Sun rises a tiny bit further south.

At the fall (observed) equinox in the northern hemisphere, the Sun rises due east and sets due west. It continues on it's journey southward until, at the winter solstice, the Sun rises are far to the southeast as it ever does, and sets as far to the southwest.



Many, if not most, prehistoric cultures tracked these rising and settings points with great detail. If they had jagged mountains along the horizon, the exact points could be readily remembered. Without a suitably interesting horizon, standing stones could be arranged to line up with the various rising and setting points. Or, tree poles could replace the standing stones. Or, rock cairns could be used.

For more details on the astronomical alignments, see [Petroform Astronomy](#).

What About the Stars – Heliacal Risings?

The rising points of the stars don't change as much as the Sun's because they are so very far away. So the rising points of stars on the horizon were not as critical to ancient cultures. However, the rising **times** of stars change by 4 minutes each day, so any particular star would rise at different times during the year. For about half the time, the star would rise during the daytime and thus be blocked by the overwhelming light of our Sun.

² See the section on Computing the Equinox

What Jack Eddy found at Bighorn were alignments to three stars during their *heliacal risings*. Heliacal risings occur after a star has been behind the Sun for a season and it is just returning to visibility. There is one morning, just before dawn, when the star suddenly reappears after its absence. On that day it "blinks" on for a moment just before the sunrise and just before it is then obliterated by the Sun's presence. That one special morning is called the star's heliacal rising. Each day that passes after the heliacal rising, the star will appear to rise earlier and remain in the sky longer (that is, not blink) before its soft glow is obliterated by the rising Sun. Thus these dawn rising were extremely useful for keeping track of exact days.



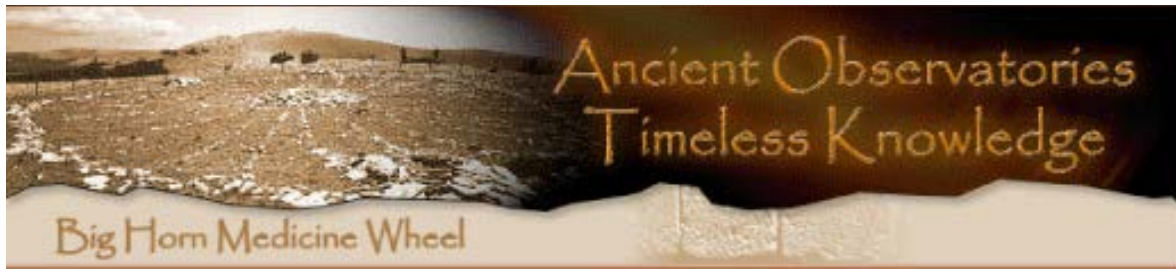
In the northern hemisphere, the heliacal rising of the bright reddish star Aldebaran heralds the coming of the summer solstice in just a couple days. Rigel, a bright bluish-white star, rises almost exactly one lunar month (28 days) after Aldebaran. Sirius, the brightest star in the night sky, rises one month after Rigel. This could account for Bighorn's 28 spokes. The rising of Sirius could be the signal to pack up and leave Bighorn because the weather was going to take a severe turn. The alignment of Fomalhaut, another bright star, occurs 28 days before the solstice.

Not all stars have heliacal risings because some stars remain above the horizon all the time. Only certain stars rise and flash into existence in the predawn glow of the horizon. Because these helical risings were so specific, just one day, they were used by many different ancient civilizations to mark specific events such as the drought season and planting time. It is not surprising that the Plains Indians would use heliacal risings to signal the coming and going of the solstice.

Computer generated heliacal risings (Quick Time required)		
<p><u>Aldebaran</u> Shown rising 2 days before the Summer Solstice</p>	<p><u>Rigel</u> Shown rising 28 days after the Summer Solstice</p>	<p><u>Sirius</u> Shown rising 28 days after Rigel's Dawn rising, and signifying the end of summer and time to leave the mountain</p>

Image credits:

- Solstice-Equinox drawing: <http://www.umass.edu/sunwheel/pages/design.html>
- Heliacal rising: Stellarium open source software



The Big Horn Medicine Wheel in Wyoming

Why is Bighorn Medicine Wheel Important?

Location: in the Medicine Wheel/Medicine Mountain National Historic Landmark in Bighorn National Forest, Wyoming

Latitude 44°49.6'

Longitude 107°55.7'

Date Constructed: 1200-1700 CE

Observed Equinox: Mar 16-17; Sep 25-26

Elevation: 9,642 feet.

Map and views of the wheel and mountain:

<http://www.wyohistory.org/encyclopedia/medicine-wheel>



On top of the Bighorn Range in Wyoming, a desolate 9,642 feet high and only reachable during the warm summer months, lies an ancient Native American construction -- an 80' diameter wheel-like pattern made of stones. At the center of the circle is a doughnut-shaped pile of stones, a cairn, connected to the rim by 28 spoke-like lines of stones. Six more stone cairns are arranged around the circle, most large enough to hold a sitting human. The central cairn is about 12 feet in diameter and 2' high.

If you stand or sit at one cairn looking towards another, you will be pointed to certain places on the distant horizon. These points indicate where the Sun rises or sets on summer solstice and where certain important stars rise heliacally, that is, first rise at dawn after being behind the Sun. The dawn stars helped foretell when the Sun ceremonial days would be coming. The area is free of snow only for 2 months -- around the summer solstice.

The wheel has 28 spokes, the same number used in the roofs of ceremonial buildings such as the Lakota Sundance lodge. These always includes an entrance to the east, facing the rising Sun, and include 28 rafters for the 28 days in the lunar cycle. The number 28 is sacred to some of the Indian tribes because of its significance as the lunar month. In

Bighorn's case, could the special number 28 also refer to the helical or dawn rising of Rigel 28 days past the Solstice, and Sirius another 28 past that? (*More below.*)

Construction

The wheel was constructed by Plains Indians around 800 years ago, and has been used and maintained by various groups since then. There is some evidence that the wheel might be much older, with only the most recent version visible. The central cairn is the oldest part, with excavations showing it extends below the wheel and has been buried by wind-blown dust. It may have supported a central pole. The star alignments are most accurate for around 1200 AD, since slight changes in the Earth's orbit have caused perturbations since. The solstice alignments remain accurate today. However, there is evidence that other wheels have been adjusted to keep up with the centuries.



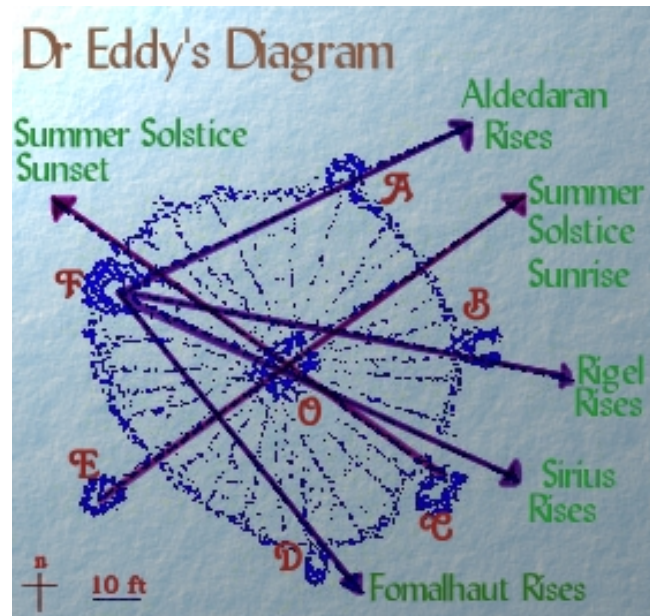
One of the rock cairns around the circle

The Bighorn wheel is part of a much larger complex of interrelated archeological sites that represent 7000 years of Native American adaptation to and use of the alpine landscape that surrounds Medicine Mountain. Numerous contemporary American Indian traditional uses include ceremonial staging areas, medicinal and ceremonial plant gathering areas, sweat lodge sites, altars offering locales and fasting (vision quest) enclosures. Examples of these can be found nearby. Ethnohistoric, ethnographic, and archeological evidence demonstrates that the Medicine Wheel and the surrounding landscape constitute one of the most important and well preserved ancient Native American sacred site complexes in North America. Prayer offerings are left even today.



Astronomical Alignments

In 1974, an archaeoastronomer named Jack Eddy visited this Medicine Wheel and studied its alignments, that is, its arrangements of rocks, cairns, and spokes. He found the arrangements point to the rising and setting places of the Sun at summer solstice, as well as the rising places of Aldebaran in Taurus, Rigel in Orion, and Sirius in Canis Major -- all bright, important stars associated with the Summer Solstice. Later another astronomer, Jack Robinson, found a cairn pair that marked the bright star Fomalhaut's rising point with the Sun 28 days before solstice.



Sighting from cairn E through the center hub (which may have supported a pole) marks the summer solstice sunrise. Sighting from C through the center marked the equivalent solstice sunset. Note the perfect alignment and reflection off the spokes.

Standing at cairn F, one could sight the once-yearly dawn, heliacal, risings of the key stars Aldebaran, Rigel, and Sirius, which play symbolic roles in an ancient [Cheyenne Massaum ceremony](#) and are also important stars in the sacred Lakota circle constellation "[The Animal](#)".



The dawn or heliacal rising of a star is important because it pinpoints a date exactly. This is the day a star is first seen, just before dawn, after it has been behind the Sun for an entire season. From about 1200 AD to 1700 AD, these 4 stars would have acted as solstice markers for the Native Americans - Fomalhaut (F to D) would rise 28 days before the Summer Solstice, Aldebaran (F to A) would rise during the 2 days just before the solstice, Rigel (F to B) would rise 28 days after the solstice, and Sirius (F to C) 28 days after that, at the end of August and hence marking the end of summer and time to leave the mountain.

Online Tours of Bighorn

[Medicine Wheel Virtual Tour](http://solar-center.stanford.edu/AO/tour.html) (<http://solar-center.stanford.edu/AO/tour.html>)

3-D Tour of Medicine Wheel

[mov format](#)

[mpg format](#)

[wmv format](#)

[View the Sun rising at Medicine Wheel](http://solar-center.stanford.edu/AO/sunrise.html)

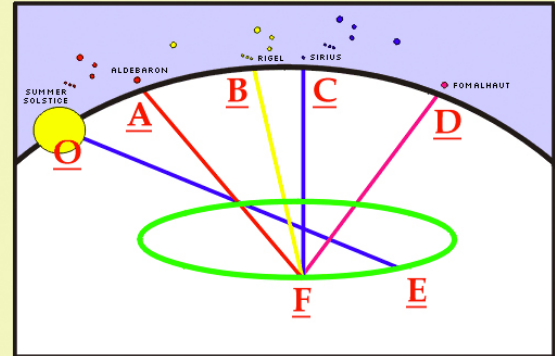
<http://solar-center.stanford.edu/AO/sunrise.html>

[View heliacal \(dawn\) risings of these stars](http://solar-center.stanford.edu/AO/dawn-rising.html)

<http://solar-center.stanford.edu/AO/dawn-rising.html>

Phases of a Medicine Wheel

Throughout the year and the rising of Orion.



Marker "O" shows summer solstice sunrise, approx. June 21.

Marker "A" shows the rising of Aldebaran as a morning star, approx. April 21.

Marker "B" shows the rising of Rigel as a morning star, approx. May 21.

Marker "C" shows the rising of Sirius as a morning star, approx. June 21.

Marker "D" shows the rising of Fomalhaut as a morning star, approx. Aug. 21.

Markers "E" and "F" are backsights for observing the other markers in sequence.

[< Principles of Archaeoastronomy](#) | [Contents](#) | [Possible Interpretation of Orion](#) >

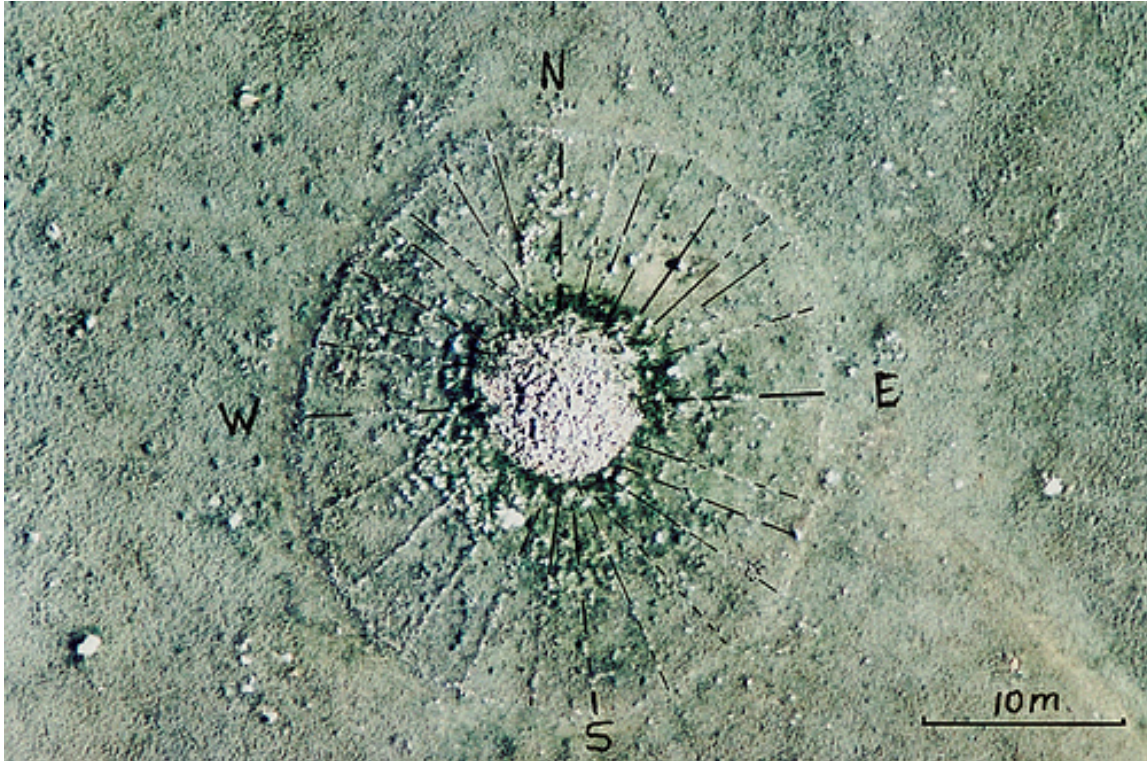
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See also: Eddy, John A, "Astronomical Alignments of the Bighorn Medicine Wheel," *Science* 184(4141):1035-1043; 1974.

Image Credits:

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- Initial Medicine Wheel photograph by Richard Collier, Wyoming State Historic Preservation Office. Used with permission.
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- Chart from original diagram by Jack Eddy
- Medicine Wheel sunset photograph by Tom Melham. Used with permission.
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- Keyhole video developed by Professor Philip Scherrer. Keyhole2 PRO, movie maker, data importer, and high speed printer modules provided thanks to Jack Veenstra and Dennis Reinhardt of Keyhole-Google.
- Map and photographic views by [Steven Dutch, Natural and Applied Sciences, University of Wisconsin - Green Bay](http://www.steven-dutch.com)
- Satellite photo from TerraServer USA
- Sun rising patterns: <http://www.umass.edu/sunwheel/pages/moonteaching.html>

Majorville Medicine Wheel in Alberta, Canada



Majorville – the Oldest Medicine Wheel

Location: Vulcan County, Alberta, Canada

When Constructed: 4,500 BP

Latitude: 50.585167N

Longitude: 112.410639W

Observed Equinox: Mar 17-18; Sep 25-26

Construction

The Majorville Medicine Wheel, the largest and oldest extant medicine wheel, consists of a central cairn that is linked to a surrounding stone circle by 28 spokes. The medicine wheel is part of an extensive cultural landscape encompassing 160 acres and situated on a height of land with an expansive view of the surrounding prairie landscape west of the Bow River in southern Alberta. The central cairn is nine meters in diameter and is surrounded by a stone circle 27 meters across. About 28 spokes link the circle and central cairn. In 1971 an excavation yielded artifacts that were dated by stone tool style. This method and radiocarbon dating of bone place initial construction of the central cairn at some 4500 BP, although another source dates the initial site to 3200 BP. The tool finds indicate a succession of added material over the centuries. Archaeological studies

indicate this site has been continuously used for the last 4,500 years, making this one of the oldest sacred sites in the world.

Alignments

Professor Gordon Freeman of Saskatchewan, an Oxford- and University of Saskatchewan- and McGill-trained scholar and Professor Emeritus at the University of Alberta studied Majorville from 1989 to 2006. Freeman found striking similarities between the surface geometry of Stonehenge and the stone patterns at Majorville. He concludes that Majorville stones are really the remains of an open-air Sun temple that predates both Stonehenge in England and the Pyramids in Egypt. According to Freeman, the Plains Indians used the temple to observe sunrise on the winter and summer solstices.

According to the Canadian Archaeological Association, “Majorville has associated with it outlying rock lines and cairns that accurately mark the Sun rise and set points on the solstices and on the [observed] equinoxes. The point of the Sun's first flash on the horizon is the rise position, and the point of the last flash on the horizon is the set position. These points move northward from December to June, then move southward again after the summer solstice. Near an equinox the Sun rise and set points at Majorville move along the horizon by 1.3 Sun diameters per day. Near a solstice it takes nine days to move the last diameter to the solstice position.

“We determine the Sun rise and set points photographically to within less than one Sun's diameter, and sometimes to within a fifth of a diameter, along alignments up to 2km long.

“Rock alignments at Majorville mark the Sun rise and set points three days before the [astronomically-defined] vernal equinox and three days after the [astronomical] autumnal equinox. [In ancient times, observers would observe the equinoxes as the two days a year when the Sun rises due east and sets due west. One these days, daylight and nighttime would be of almost exactly equal length. These east-west days are determined by latitude, hence they differ from the astronomically defined equinoxes: “the time at which the Sun crosses the celestial equator.” Hence Majorville reflects the equinox as observed by the people of the time, not as defined by modern astronomers³.]

“These days [the observed equinoxes] are within two minutes of being exactly 12 hours long. The lens effect of the atmosphere causes the length of the solar equinoctial days to be about 12 hours and 10 minutes long at Majorville. The position of sunrise on the 12.00 hour day is marked by a spoke in the Medicine Wheel, which points to a large white limestone in the East House 61m away, and to a configured part of the eroded river bank 1100m away. Rocks have slid down the eroded bank from the sightline position. The Sun rises over the horizon about 30km distant.

“A more spectacular 12.00 hour day sunrise marker involves two V sights of rocks separated by 70m, on the west side of the Medicine Wheel hill. The sighting line is

³ See section on calculating the equinoxes

tangent to the Wheel. Because one is looking up the shaded side of the hill, the Sun becomes visible in the nested bottoms of the V's a half hour after the first flash on the distant horizon. Thus, one can observe the equinox sunrise even if the distant horizon is overcast to a depth of several sun diameters. The 12.00 hour day sunset is marked by a spoke of the Wheel which points to a small cairn on a hillock 1100m away and to a ripple on the horizon about 10km distant. The important part of the Majorville Medicine Wheel site covers 13km. It is 20,000 times larger than previously thought.”

See also:

- Gordon R. Freeman, *Canada's Stonehenge – Astounding Archaeological Discoveries in Canada, England, and Wales*, Kingsley Publishing, 2009.
- Gordon R. Freeman, “*Hidden Stonehenge: Ancient Temple in North America Reveals the Key to Ancient Wonders*”, Watkins, 2012.
- <http://canadianarchaeology.com/caa/node/2628>
- <http://www.megalithic.co.uk/article.php?sid=22751>

Images:

- Gordon Freeman's aerial photo of the Majorville Medicine Wheel, with the 28 spokes highlighted in black. From <http://www.atlasobscura.com/articles/the-medicine-wheels-of-north-america>
- Central cairn <http://www.redicecreations.com/article.php?id=20738>



Cultural Connections

The Bighorn Medicine Wheel remains a part of Native American ritual life even today. About 60 tribes visit the site annually, and conduct some 180 sacred ceremonies there. There are other sites as well that show the veneration Native Americans held for the Sun, the Earth, and their sacred connections.

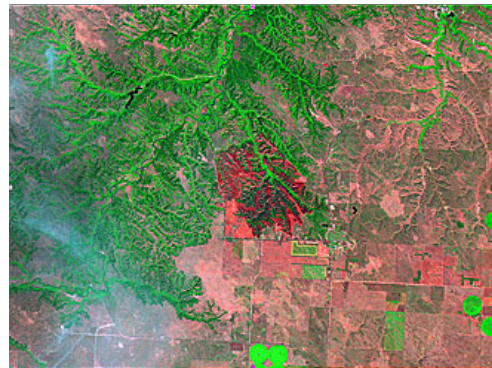
Sacred Chaco Canyon

Ancient peoples in the Chaco Canyon area of New Mexico designed their massive spiritual center with solar alignments and markers playing dramatic and visual roles. The image at right shows the Sundagger, a shaft of light bisecting a carved spiral at noon on the Winter Solstice. For more information about Chaco, visit [Chaco Canyon](#) by the Exploratorium and [Traditions of the Sun](#), a NASA visual exploration of Chaco.



Native Views from Space

"Through traditional customs and symbols like the medicine wheel, a circular arrangement of stones often interpreted as representing the relationship between Earth, air, water and fire, Native Americans have long recognized and celebrated the connectedness among all natural things. Indeed, the Native American view of the world has always been consistent with that of Earth system science -- that Earth is a single system of interconnected parts." NASA's [Native Views from Space](#) site explores interactions between Earth's various components, including the Medicine Wheel, in a new light. The image, from NASA's Landsat 7 satellite helped support damage assessment after a fire on the lands of South Dakota's Sioux Tribe.



The Sun Dance

For many of the Plains Indians, including the Lakota, the [Sundance](#) or [Wiwanyag Wachipi](#) was their major communal religious ceremony. Generally held in the late spring or early summer, the rite celebrates renewal, spiritual rebirth, and regeneration of the living Earth with all its components. The ritual involves staring at the Sun while dancing, personal sacrifice, and supplication to insure harmony between all living things. There is a symbolic role played by animals in the sundance as well. Contemporary Native Americans continue the Sundance today ([the modern Sundance Ceremony](#)).

Oral Traditions and the Medicine Wheels

Native Americans relied almost solely on oral traditions to pass along important knowledge through the generations. Very little is known about the origins of the Medicine Wheels because much of the history and these oral traditions have been lost. Some say that medicine wheels were a guide from the heavens to build the first tipis. Other legends note that they were built "before the light came." One Crow story speaks of a man named Scarface:



"Scarface was handsome and was fond of strutting in his finery before young women. One day while entering his mother's tipi, he fell into the fire, that severely burned his face. He was thereafter embarrassed to be seen. Shamed at his appearance, he left his people and went to live in the mountains. Scarface lived alone for many years. One day while a young woman and her grandmother were hunting berries, they became separated from their people and couldn't find their way back. They traveled along a trail that took them into the mountains. They occasionally saw Scarface and one day made contact with him. Scarface later married the young woman. On their travels back to his people, Scarface supposedly built the Medicine Wheel as their shelter. On the second day he built another tipi by the Bighorn River in the valley below. The tipi rings are believed to still exist." Tale from [Bighorn Medicine Wheel](#)

Many claim that the Medicine Wheels symbolize all creation, all peoples and all animals. It's circular shape echoes the cycles of the Earth, Sun, seasons, and life. For more on Native American spirituality, see [Native American Myths](#).

Similar Alignments at Cahokia "Woodhenge"

When the equinoxes arrived in the ancient city of Cahokia, near present-day St. Louis, priests watched the sunrise from inside a ring of cedar poles that served as a calendar very similar to the Medicine Wheels. Built by the Mississippian culture, the city of Cahokia arose around 700 AD and for hundreds of years served as the center of a huge trading network linked to other societies of North America. Cahokia was one of the most advanced civilizations in ancient America. It reached its zenith around 1100-1200 AD, when its population swelled to as much as 20,000.

Cohokian inhabitants built a series of large calendrical circles ringed with wooden poles. These may have served a similar function to the Medicine Wheels. Instead of stone,

Cahokians used red cedar posts 15 to 20 inches in diameter and about 20 feet long. Each circle consisted of a central Sun-watching station, surrounded by a ring of cedar poles.

Watching from the center, a priest would see the Sun aligned with the poles on the solstices, equinoxes, and other important solar dates. Archaeologists have named these circles Woodhenges because of their resemblance to England's Stonehenge.



Cahokians eventually faced a series of problems driven by overpopulation, poor environmental practices (including cutting down all their trees), and a change in climate. By 1400, the city was abandoned.

Archaeologists have rebuilt one of the Woodhenge circles, that you can see at [Cahokia Mounds State Historic Site](#). Learn more about Cahokia at [Ancient Cahokia](#) (a site by the Washington Post).

Beliefs about the Sun and Stars by the Plains Indians

The Lakota Sioux call the Sun "Wiyo ate" and say "The light of the Sun enlightens the entire universe, and as the flames of the Sun come to us in the morning, so comes the grace of [Wakan Tanka](#), by which all creatures are enlightened. It is because of this that the four-leggeds and the wingeds always rejoice at the coming of the light. We can all see in the day, and this seeing is sacred for it represents the sight of that real world which we may have through the eye of the heart." [Black Elk](#)



To these same people, the stars (Wichahpi) are [wakan](#) -- holy, sacred, powerful, and mysterious. "Sometimes they come to the world and sometimes the Lakotas go to them. There is one star for the evening and one for the morning. One star never moves [the North Star]; other stars move in a circle about it. They are dancing in the dance circle. There are seven stars. This is why there are seven council fires among the Lakotas. The Spirit Way is among the stars. It begins at the edge of the world. No man can find it. Wakan Tanka keeps the bad spirits away from the Spirit Way." [Ringing Shield](#)

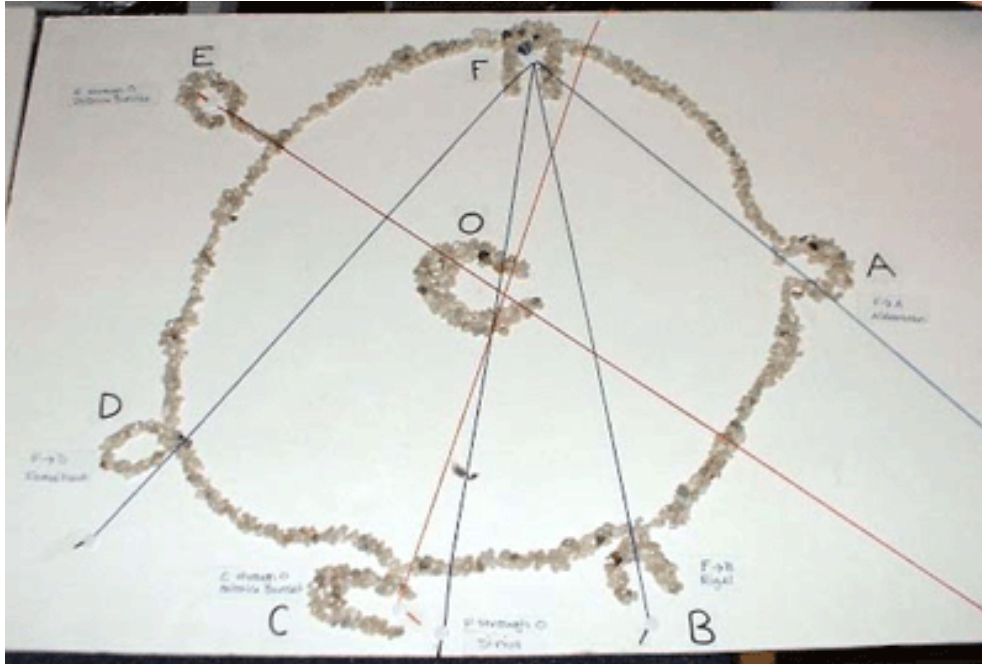


Image credits:

- Sundagger image by The Solstice Project; used with permission.
- USGS satellite image
- Storeytelling <http://nativeliterature.org/>
- Cohokia Woodhenge, Wiki Commons
- Sunrise at Chaco photograph courtesy Deborah Scherrer
- Elaborate solar (?) petroglyph photograph courtesy Deborah Scherrer, Chaco Canyon.

Medicine Wheel Classroom Activities

Foamboard and Pebble Medicine Wheel Model



Students learn much by designing and developing models. Here, Shannon Lee, A graduate student in astrophysics, made a simple model of the Bighorn Medicine Wheel. She used foam board, pebbles, and string to model the stellar and solar alignments. She worked from [Dr. Jack Eddy's diagram](#) as well as a visit to the actual site.

What Medicine Wheels are interesting to you? Could you build a model of them?

Build your own Sun Track Diorama

People often find it difficult to visualize the track of the Sun across the sky through the seasons, and to understand the concept of solstices and equinoxes. After much experimentation and effort, the Stanford Solar Center came up with these models. The dioramas simulate the rising and setting points of the Sun, and its tracks across the sky at summer solstice (longest track), winter solstice (shortest track), and the spring and fall equinoxes (central track). A bead placed on one of the tracks simulates the Sun rising along the eastern horizon,



traveling along the sky, and setting on the western horizon. Using the models helps, but actually constructing them allows participants to more deeply understand the concepts of solstice and equinox.

Directions for building this Suntrack model are available online at <http://solar-center.stanford.edu/activities/Suntrack-Model/Suntrack-Model.pdf>

Once you have built your model, imagine a tiny version of yourself standing in the middle of the wooden disk. Imagine the outside rim of the disk represents your horizon.

On Summer Solstice, you would see the Sun rise on your "horizon" at the eastern point of the longest track. It would follow the track high in your sky, and eventually set on the western horizon. It would be up for about 17 "hours", thus making summertime days long and warm. On the Winter Solstice, you would observe the Sun rising at the western end of the smallest track. It wouldn't rise high in the sky, and would be up for only about 6 or 7 hours, making your days short on daylight and cold. At the Spring and the Fall equinoxes, the Sun would rise at the east end of the middle track and set at the west end. Your days would be exactly half daylight and half nighttime and you would experience typical warm/cool spring and fall climates.



A Simple Chalk-and-String Wheel

The Chabot Space and Science Center in Oakland, California has designed an activity to build your own simple Medicine Wheel on your schoolyard, using only string and chalk. Of course, you could always add rocks! See [Sunwatchers of the Southwest](#) (pdf).

DDSB Aboriginal Welcome Wheel Lesson Plan Series:

[http://www.ddsb.ca/Programs/aboriginaled/Resources/learningWheels/Learning%20Wheels/ddsb_welcome_wheel_series - intro the the medicine wheel.pdf](http://www.ddsb.ca/Programs/aboriginaled/Resources/learningWheels/Learning%20Wheels/ddsb_welcome_wheel_series_-_intro_the_the_medicine_wheel.pdf)

A Reason for the Season

A National Geographic activity about seasons.

<http://education.nationalgeographic.com/archive/xpeditions/activities/07/season.html>

Build Your Own Wheel on Campus

A Stonewheel for the Campus -- A Large and Elaborate Wheel at UMass.

Professor Judith S. Young at the University of Massachusetts, Amherst, has built a standing-stones based medicine wheel on the university campus. See [A Sunwheel for the Campus](#)



Marcus Whitman High School Medicine Wheel

A medicine wheel 28 feet in diameter, constructed by Pete Saracino and John Fiori, teachers at Marcus Whitman High School in Rushville, New York. Featured on [Earth Science Picture of the Day](#)



Valley City State University, North Dakota's Medicine Wheel

Dr. Joe Stickler at the Department of Science, Valley City State University in Valley City, ND and his 1992 Astronomy class built their own medicine wheel. See [Valley City State University Medicine](#)



Image Credits:

- Foamboard model photo by Ben Burress, Chabot Space and Science Center. Used with permission.
- Suntrack dioramas designed by Deborah Scherrer and Barbara Scherrer. Suntrack model photographs courtesy of Deborah Scherrer.
- UMass sunwheel photograph by Judy Young. See also <http://www.umass.edu/sunwheel/pages/moonteaching.html>
- Marcus Whitman High School <http://epod.usra.edu/blog/2005/10/medicine-wheel.html>
- Valley State Medicine Wheel <http://medicinewheel.vcsu.edu/>

Learning about the Medicine Wheels

Trying to unravel the mysteries of medicine wheels can seem like a daunting task. Where does one begin? Do you try to figure out how old it is and then attempt to decipher its purpose, or do you try to find a purpose to help figure out how old it is? Sometimes it can seem like an endless circle. Exploring medicine wheels offers the exciting prospect of integrating different fields of study together to assist in unraveling a complex puzzle.

Archaeology

Archaeology is the study of the human past through materials that are left behind. You can piece together the truth about a society through examination of ancient structures, artifacts like pottery and tools, art pieces, and if it is available, oral tradition. Because the builders of the Medicine Wheels are long gone, we have to use archaeology to learn more about the ancient peoples of North America. To interpret their structures, we need to have a better understanding of their culture, how they lived, and, to the extent possible, what were their beliefs. Of course, it is extremely important to work with and understand the living descendants of the cultures you are studying. If you'd like to learn more about archaeology, check out: [Archaeology in South Dakota](#).



Archaeologist Amanda ("Rin") Scherrer

Cultural Anthropology

Culture is a part of every human society. It can be defined as our way of life, our morals, our social structure, our art, and our customs. It can be anything dealing with the dynamic human experience. Cultural anthropology is the study of the broad range of human culture, whether it be modern or ancient. It is important to understand the culture of the Native American people before you speculate about why they might build medicine wheels.

Carbon Dating

Carbon dating (radioactive dating) is one of the most effective ways we have of discovering the age of organic material. Carbon 14 is an element present in all organic matter. It is formed into carbon dioxide in the atmosphere and absorbed by plants during photosynthesis. Carbon 14 has a half life of 5,700 years, which is the time it takes for half of the carbon 14 in a sample to decay. We can use this half life to date a piece of organic matter by comparing how much carbon 14 remains to how much is found normally. See [How Carbon-14 Dating Works](#). Rocks are not made of organic matter so cannot be dated. However, remains of fire pits or scraps of wood used as central poles can help us determine how old a medicine wheel site might be.

Astronomy

There is strong evidence that at least some medicine wheels point to the Sun and some important stars. The study of astronomy is necessary to understand where objects are in the sky and how the passage of time affects their positions. Being an astronomer helped Jack Eddy discover the unique aspects of the Bighorn Mountain medicine wheel.



Calculating the Equinoxes

Most dictionaries erroneously define the equinox as: “the time or date (twice each year) at which the Sun crosses the celestial equator, when day and night are of equal length (about September 22 and March 20)”. However, there is no place on Earth where the day and night are of equal length on the given days.

Latitude Determines Day Length

In fact, **latitude** determines day length. Even if day and night aren’t exactly equal on the day of the equinox, there are days when day and night are both very close to 12 hours. However, this date depends on the location’s latitude, and can vary by as much as several weeks. The table shows approximate dates for when day and night are as similar as possible according to latitude.

Approximate date of “equal day and night”		
<i>Latitude</i>	<i>March</i>	<i>September</i>
90° North	Sun rises ~Mar 19	Sun sets ~Sep 24
80° North	Mar 17-18	Sep 24-25
60° North	Mar 17-18	Sep 24-25
55° North	Mar 17-18	Sep 24-25
50° North	Mar 17-18	Sep 25-26
45° North	Mar 16-17	Sep 25-26
40° North	Mar 16-17	Sep 25-26
35° North	Mar 15-16	Sep 26-27
30° North	Mar 15-16	Sep 26-27
25° North	Mar 14-15	Sep 27-28
20° North	Mar 13-14	Sep 29-30
15° North	Mar 11-12	Sep 30-31
10° North	Mar 7-8	Oct 5-6
5° North	Feb 25-26	Oct 17-18
Equator	No equal day and night	
5° South	Apr 14-15	Aug 28-29
10° South	Mar 31-Apr 1	Sep 10-11
15° South	Mar 28	Sep 13-14
20° South	Mar 26-27	Sep 16-17
25° South	Mar 24-25	Sep 16-17
30° South	Mar 23-24	Sep 18-19
35° South	Mar 23-24	Sep 18-19
40° South	Mar 23-24	Sep 19-20
45° South	Mar 23-24	Sep 19-20
50° South	Mar 22-23	Sep 19-20
55° South	Mar 22-23	Sep 19-20
60° South	Mar 22-23	Sep 19-20
80° South	Mar 22-23	Sep 20-21
90° South	Sun sets ~Mar 22	Sun rises ~Sep 20

Geometry Affects Day Length

On the equator, the day and night stay approximately the same length all year round, but the day will always appear a little longer than 12 hours. On the equinoxes, the geometric center of the Sun is above the horizon for 12 hours, and you might think that the length of the day (hours of daylight) would be 12 hours too. However, 'sunrise' is defined as the moment the upper edge of the Sun's disk becomes visible above the horizon – not when the center of the Sun is visible. In the same sense, 'sunset' refers to the moment the Sun's upper edge, not the center, disappears below the horizon. The time it takes for the Sun to fully rise and set, which is several minutes, is added to the day and subtracted from the night, and therefore the equinox day technically lasts a little longer than 12 hours.

Refraction Affects Day Length

Another problem is that the Earth's atmosphere refracts, or bends, sunlight. This causes the Sun's upper edge to be visible from Earth several minutes before the edge actually reaches the horizon. The same thing happens at sunset, when you can see the Sun for several minutes after it has actually dipped under the horizon. So, every day on Earth – including the days of the equinoxes – is at least 6 minutes longer than it would have been without this refraction. Making this even more complicated -- the extent of refraction depends on atmospheric pressure and temperature.

Above information and chart from: <http://www.timeanddate.com/astronomy/equinox-not-equal.html> and with adaptations from Gordon R. Freeman, *Canada's Stonehenge – Astounding Archaeological Discoveries in Canada, England, and Wales*, Kingsley Publishing, 2009.

How Ancient Cultures Determined the Equinoxes

The peoples who built the great Medicine Wheels, Stonehenge, Chaco Canyon, Machu Picchu and the others did not have clocks to calculate minutes of daytime/nighttime. We have no idea whether that was even important to them. What these peoples did know was that the rising and setting points of the Sun moved, just slightly, each day during a year. Using standing stones, poles, notches on the horizon, whatever, they could easily tell when the Sun reached its most northern rising/setting points (Summer Solstice), and the most southern (Winter Solstice). **They could also tell when the Sun rose exactly due east and set exactly due west.** To them, this was their equinox, the time halfway between farthest north and farthest south, between Summer Solstice and Winter Solstice.

Hence applying the standard astronomical equinox dates to an ancient monument will not usually work. To know when an equinoxial alignment for a particular site is correct, one has to take into account latitude, and the chart above. True equinox dates have been added to the descriptions for each site.

These concepts, and the reasons for the misconceptions, are beautifully described by Gordon R. Freeman in his book *Canada's Stonehenge – Astounding Archaeological Discoveries in Canada, England, and Wales*, Kingsley Publishing, 2009.

Modern Solar Observatories

A sampling

Ground-based

- Big Bear Solar Observatory: <http://www.bbso.njit.edu/>
- Cerro Tololo Interamerican Observatory, Chile: <http://www.ctio.noao.edu/noao/>
- Crimean Astrophysical Observatory:
https://en.wikipedia.org/wiki/Crimean_Astrophysical_Observatory
- El Teidi Observatory, Canary Islands: <http://www.iac.es/eno.php?op1=3&lang=en>
- Mauna Loa Solar Observatory:
https://en.wikipedia.org/wiki/High_Altitude_Observatory
- McMath-Pierce Solar Telescope, Kitt Peak:
<http://www.noao.edu/outreach/kptour/mcmath.html>
- Mees Solar Observatory: <http://www.solar.ifa.hawaii.edu/>
- Mt. Wilson Solar Tower: <http://obs.astro.ucla.edu/intro.html>
- Stanford's Wilcox Solar Observatory: <http://wso.stanford.edu/>
- Udaipur Solar Observatory, India: <http://www.prl.res.in/~uso/>
- US National Solar Observatory: <http://www.nso.edu/>

Satellites and spacecraft

- ESA/NASA Solar and Heliospheric Observatory (SOHO):
<http://sohowww.nascom.nasa.gov/>
- NASA Solar Dynamics Observatory (SDO): <http://sdo.gsfc.nasa.gov/>
- NASA Interface Region Imaging Spectrograph (IRIS): <http://iris.gsfc.nasa.gov/>
- NASA Magnetospheric Multiscale Mission (MMS): <http://mms.gsfc.nasa.gov/>
- NASA STEREO: <http://stereo.gsfc.nasa.gov/>
- NASA HINODE: <http://hinode.msfc.nasa.gov/>
- NASA TRACE: <http://science.nasa.gov/missions/trace/>
- NASA RHESSI: <http://hesperia.gsfc.nasa.gov/rhessi3/>



SDO image courtesy NASA