

## *Winter solstice in Northern Hemisphere and over Asia.*

*Winter solstice is an astronomical phenomenon which for the Northern Hemisphere occurs in December and which for the Southern Hemisphere occurs in June. For the Northern Hemisphere, the moment of winter solstice is when the sun's elevation with respect to the North Pole is at its most negative value since the previous December. (The elevation with respect to the South Pole is at its greatest since the previous December). The hemisphere has its longest night and shortest day around the moment of solstice with the night within the Arctic being 24 hours long.*

*Analogous remarks hold for the Southern Hemisphere. Thus, for the Southern Hemisphere, at the moment of its winter solstice in June, the sun is at its greatest height as observed from the North Pole.*

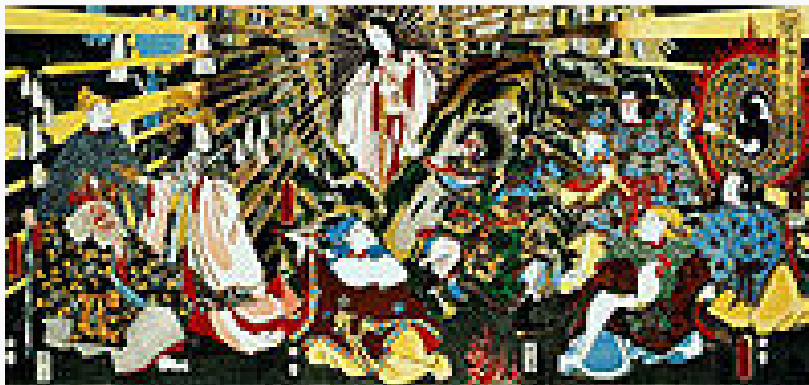
*Depending on one's position on the globe, the December solstice usually, occurs on the 21st and the 22<sup>nd</sup>. The June solstice usually occurs on June the 20th or 21st. However, it is sometimes possible for a solstice to coincide with three different dates. Thus the December 2016 solstice coincides with 20th of the month in American Samoa, with the 21st in London and with the 22nd at Kiribati.*

The axial tilt of Earth and gyroscopic effects of the planet's daily rotation keep the axis of rotation pointed at the same point in the sky. As the Earth follows its orbit around the Sun, the same hemisphere that faced away from the Sun, experiencing winter, will, in half a year, face towards the Sun and experience summer. Since the two hemispheres face opposite directions along the planetary pole, as one polar hemisphere experiences winter, the other experiences summer.

More evident from high latitudes, a hemisphere's winter solstice occurs on the shortest day and longest night of the year, when the sun's daily maximum elevation in the sky is the lowest.<sup>[3]</sup> The winter solstice itself lasts only a moment in time, so other terms are used for the day on which it occurs, such as "midwinter", or "the shortest day". For the same reason, it should not be confused with "the first day of winter" or "the start of winter" (*Lidong* in the East Asian calendars). The seasonal significance of the winter solstice is in the reversal of the gradual lengthening of nights and shortening of days. The earliest sunset and latest sunrise dates differ from winter solstice, however, and these depend on latitude, due to the variation in the solar day throughout the year caused by the Earth's elliptical orbit (see *earliest and latest sunrise and sunset*).

Worldwide, interpretation of the event has varied from culture to culture, but many cultures have held a recognition of rebirth, involving holidays, festivals, gatherings, rituals or other celebrations around that time.

## History and cultural significance



Japanese Sun goddess Amaterasu emerging from a cave.

The solstice itself may have been a special moment of the annual cycle of the year even during Neolithic times. Astronomical events which during ancient times controlled the mating of animals, sowing of crops and metering of winter reserves between harvests, show how various cultural mythologies and traditions have arisen. This is attested by physical remains in the layouts of late Neolithic and **Bronze Age** archaeological sites, such as **Stonehenge** in Britain and **Newgrange** in Ireland. The primary axes of both of these monuments seem to have been carefully aligned on a sight-line pointing to the winter solstice sunrise (Newgrange) and the winter solstice sunset (Stonehenge). Significant in respect of Stonehenge is the fact that the **Great Trilithon** was erected outwards from the centre of the monument, i.e., its smooth flat face was turned towards the midwinter Sun.



Neolithic site of Goseck circle. The yellow lines are the direction the Sun rises and sets at winter solstice.

The winter solstice may have been immensely important because communities were not certain of living through the winter, and had to be prepared during the previous nine months. **Starvation** was common during the first months of the winter, January to April (northern hemisphere) or July to October (southern hemisphere), also known as "the **famine months**". In temperate climates, the midwinter festival was the last feast **celebration**, before deep winter began. Most cattle were **slaughtered** so they would not have to be fed during the winter, so it was almost the only time of year when a supply of fresh meat was available. The majority of wine and beer made during the year was finally **fermented** and ready for drinking at this time. The concentration of the observances were not always on the day commencing at midnight or at dawn, but the beginning of the pre-Romanized day, which falls on the previous **eve**.

Since the event is seen as the reversal of the *Sun's* ebbing presence in the sky, concepts of the birth or rebirth of *sun gods* have been common and, in cultures using winter solstice based cyclic calendars, the year as reborn has been celebrated with regard to *life-death-rebirth deities* or new beginnings such as *Hogmanay's* redding, a New Year cleaning tradition. Also reversal is yet another usual theme as in *Saturnalia's* slave and master reversals.



*Sunrise at Stonehenge on the Winter Solstice*

Direct observation of the solstice by amateurs is difficult because the sun moves too slowly at either solstice to determine its specific day, let alone its instant. Knowledge of when the event occurs has only recently been facilitated to near its instant according to precise *astronomical data tracking*. It is not possible to detect the actual instant of the solstice (by definition, one cannot observe that an object has stopped moving until one makes a second observation in time showing that it has not moved further from the preceding spot, or that it has moved in the opposite direction). Further, to be precise to a single day, one must be able to observe a change in *azimuth* or elevation less than or equal to about  $1/60$  of the angular diameter of the sun. Observing that it occurred within a two-day period is easier, requiring an observation precision of only about  $1/16$  of the angular diameter of the sun. Thus, many observations are of the day of the solstice rather than the instant. This is often done by watching the sunrise and sunset or vice versa or using an *astronomically aligned instrument* that allows a ray of light to cast on a certain point around that time. Before the *scientific revolution*, many forms of observances, astronomical, symbolic or ritualistic, had evolved according to the beliefs of various cultures, many of which are still practiced today.