# Solstice

## From Wikipedia, the free encyclopedia

(Redirected from Shortest day)
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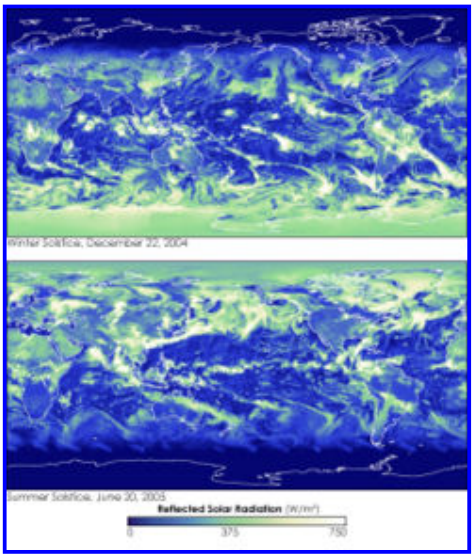
*For other uses, see Solstice (disambiguation).*




Two images showing the amount of reflected sunlight at southern and northern summer solstices respectively (watts / m²).

**UTC Date and Time of Solstice and Equinox**

| year | Equinox Mar | | Solstice June | | Equinox Sept | | Solstice Dec | |
|---|---|---|---|---|---|---|---|---|
| | day | time | day | time | day | time | day | time |
| **2002** | 20 | 19:16 | 21 | 13:24 | 23 | 04:55 | 22 | 01:14 |
| **2003** | 21 | 01:00 | 21 | 19:10 | 23 | 10:47 | 22 | 07:04 |
| **2004** | 20 | 06:49 | 21 | 00:57 | 22 | 16:30 | 21 | 12:42 |
| **2005** | 20 | 12:33 | 21 | 06:46 | 22 | 22:23 | 21 | 18:35 |
| **2006** | 20 | 18:26 | 21 | 12:26 | 23 | 04:03 | 22 | 00:22 |
| **2007** | 21 | 00:07 | 21 | 18:06 | 23 | 09:51 | 22 | 06:08 |
| **2008** | 20 | 05:48 | 20 | 23:59 | 22 | 15:44 | 21 | 12:04 |
| **2009** | 20 | 11:44 | 21 | 05:45 | 22 | 21:18 | 21 | 17:47 |
| **2010** | 20 | 17:32 | 21 | 11:28 | 23 | 03:09 | 21 | 23:38 |
| **2011** | 20 | 23:21 | 21 | 17:16 | 23 | 09:04 | 22 | 05:30 |
| **2012** | 20 | 05:14 | 20 | 23:09 | 22 | 14:49 | 21 | 11:11 |
| **2013** | 20 | 11:02 | 21 | 05:04 | 22 | 20:44 | 21 | 17:11 |
| **2014** | 20 | 16:57 | 21 | 10:51 | 23 | 02:29 | 21 | 23:03 |

A **solstice** occurs twice a year, whenever Earth's axis tilts the most toward or away from the Sun, causing the Sun to be farthest north or south at noon. The name is derived from Latin *sol* (sun) and *sistere* (to stand still), because at the solstice, the Sun stands still in declination, that is, it reaches a maximum or a minimum. The term *solstice* can also be used in a wider sense as the date (day) that such a passage happens. The solstices, together with the equinoxes, are related to the seasons. In some languages they are considered to start or separate the seasons; in others they are considered to be center points (in English, in the Northern hemisphere, for example, the period around the June solstice is known as midsummer, and Midsummer's Day is the 24 June — now two or three days after the solstice).

## Contents

[hide]



## [edit] Names

The two solstices can be distinguished by different pairs of names, depending on which feature one wants to stress.

- **Summer solstice** and **winter solstice** are the most common names. However, these can be ambiguous since seasons of the northern

hemisphere and southern hemisphere are opposites, and the summer solstice of one hemisphere is the winter solstice of the other.

- **Northern solstice** and **southern solstice** indicate the direction of the sun's movement. The northern solstice is in June on Earth, when the sun is directly over the Tropic of Cancer in the Northern Hemisphere, and the southern solstice is in December, when the sun is directly over the Tropic of Capricorn in the Southern Hemisphere. Some consider these terms to be the most neutral and unambiguous.
- **June solstice** and **December solstice** are an alternative to the more common "summer" and "winter" terms, but without the ambiguity for which hemisphere they are intended. They are still not universal, however, as not all people on Earth use a solar-based calendar where the solstices occur every year in the same month (as they do not in the Jewish calendar, for example), and the names are also not useful for other planets (Mars, for example), even though these planets do have seasons.
- **First point of Cancer** and **first point of Capricorn**. One disadvantage of these names is that, due to the precession of the equinoxes, the astrological signs where these solstices are located no longer correspond with the actual constellations.
- **Taurus solstice** and **Sagittarius solstice** are names that indicate in which constellations the two equinoxes are currently located. These terms are not widely used, though, and until December 1989 the first solstice was in Gemini, according to official IAU boundaries.

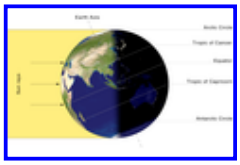
### [edit] Solar solstice terms in East Asia

*Main articles: Xiazhi and Dongzhi*

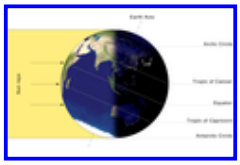
The traditional East Asian calendars divide a year into 24 solar terms (節氣). **Xiàzhì** (pīnyīn) or **Geshi** (rōmaji) (Chinese and Japanese: 夏至; Korean: 하지; Vietnamese: H• chí; literally: "summer solstice") is the 10th solar term. It begins when the Sun reaches the celestial longitude of 90° and ends when the Sun reaches the longitude of 105°. Xiàzhì more often refers in particular to the day when the Sun is exactly at the celestial longitude of 90°. In the Gregorian calendar, Xiàzhì usually begins around June 21 and ends around July 7.

**Dōngzhì** (pīnyīn) or **Tōji** (rōmaji) (Chinese and Japanese: 冬至; Korean: 동지; Vietnamese: •ông chí; literally: "winter solstice") is the 22nd solar term. It begins when the Sun reaches the celestial longitude of 270° and ends when the Sun reaches the longitude of 285°. Dōngzhì more often refers in particular to the day when the Sun is exactly at the celestial longitude of 270°. In the Gregorian calendar, Dōngzhì usually begins around December 21 (December 22 East Asia time) and ends around January 5. The Chinese character 至 means extreme, so the terms for the summer and winter solstice directly signify the summits of summer and winter, a linkage absent in Western languages.

## [edit] Heliocentric view of the seasons



Illumination of Earth by Sun at the northern solstice.



Illumination of Earth by Sun at the southern solstice.

Diagram of the Earth's seasons as seen from the north. Far right: southern solstice

Diagram of the Earth's seasons as seen from the south. Far left: northern solstice

The cause of the seasons is that the rotation axis of the Earth is not perpendicular to its orbital plane, but currently makes an angle of about 23.44° (called the "obliquity of the ecliptic"), and that the axis keeps its orientation with respect to inertial space. As a consequence, for half a year (from around 20 March to 22 September) the northern hemisphere tips to the Sun, with the maximum around 21 June, while for the other half year the southern hemisphere has this honour, with the maximum around 21 December. The two moments when the inclination of Earth's rotation axis has maximum effect are the solstices.

The table above gives the instances of equinoxes and solstices over several years. Refer to the equinox article for some remarks.

During the northern solstice the Sun appears to be directly overhead at noon for places situated at latitude 23.44° north, known as the tropic of Cancer. Likewise during the southern solstice the same thing happens for latitude 23.44° south, known as the tropic of Capricorn. All places on Earth in

between these two latitudes are known as the tropics and will see the Sun in the zenith at least two days in the year.

Also during the northern solstice places situated at latitude 66.56° north, known as the Arctic Circle will see the Sun just on the horizon during midnight, and all places north of it will see the Sun above horizon for 24 hours. That is the midnight sun or midsummer-night sun or polar day. On the other hand, places at latitude 66.56° south, known as the Antarctic Circle will see the Sun just on the horizon during midday, and all places south of it will not see the Sun above horizon at any time of the day. That is the polar night. During the southern solstice the effects on both hemispheres are just the opposite.

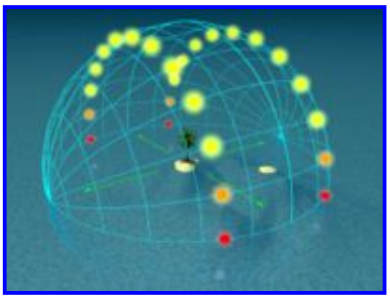
At the temperate latitudes, during summer the Sun remains longer and higher above the horizon, while in winter it remains shorter and lower. This is the cause of summer heat and winter cold.

*Further information: effect of sun angle on climate*

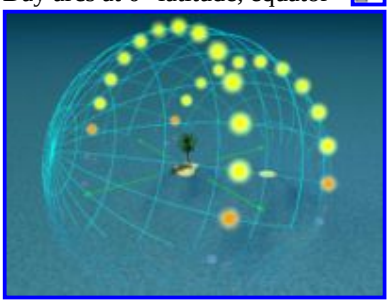
The seasons are not caused by the varying distance of Earth to the Sun due to the orbital eccentricity of the Earth's orbit. This variation does make such a contribution, but is small compared to the effects of exposure because of Earth's tilt. Currently the Earth reaches perihelion at the beginning of January, which is during the northern winter and the southern summer. The Sun, being closer to Earth and therefore hotter, does not cause the whole planet to enter summer. Although it is true that the northern winter is somewhat warmer than the southern winter, the placement of the continents, ice-covered Antarctica in particular, may also play an important factor. In the same way, during aphelion at the beginning of July, the Sun is farther away, but that still leaves the northern summer and southern winter as they are with only minor effects.

Due to Milankovitch cycles, the Earth's axial tilt and orbital eccentricity will change over thousands of years. Thus in 10,000 years one would find that Earth's northern winter occurs at aphelion and its northern summer at perihelion. The severity of seasonal change — the average temperature difference between summer and winter in location — will also change over time because the Earth's axial tilt fluctuates between 22.1 and 24.5 degrees.

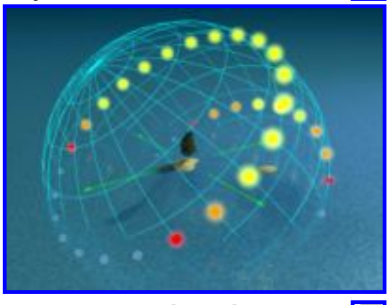
## [edit] Geocentric view of the seasons



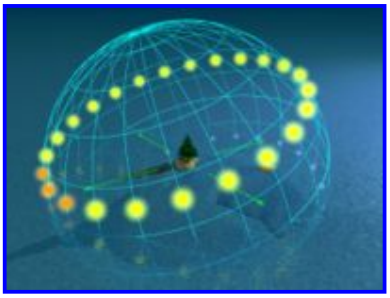
Day arcs at 0° latitude, equator



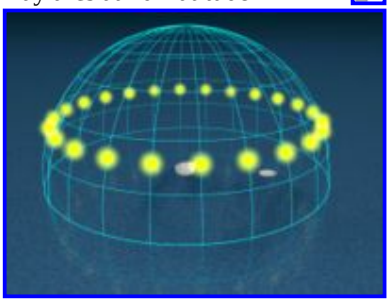
Day arcs at 20° latitude



Day arcs at 50° latitude



Day arcs at 70° latitude



Day arcs at 90° latitude, pole

The explanation given in the previous section is useful for observers in outer space. They would see how the Earth revolves around the Sun and how the distribution of sunlight on the planet would change over the year. To observers on Earth, it is also useful to see how the Sun seems to revolve around them. These pictures show such a perspective as follows. They show the day arcs of the Sun, the paths the Sun tracks along the celestial dome in its diurnal movement. The pictures show this for every hour on both solstice days. The longer arc is always the summer track and the shorter one the winter track. The two tracks are at a distance of 46.88° (2 × 23.44°) away from each other.

In addition, some 'ghost' suns are indicated below the horizon, as much as 18° down. The Sun in this area causes twilight. The pictures can be used for both the northern and southern hemispheres. The observer is supposed to sit near the tree on the island in the middle of the ocean. The green arrows give the cardinal directions.

- On the northern hemisphere the north is to the left, the Sun rises in the east (far arrow), culminates in the south (to the right) while moving to the right and sets in the west (near arrow). Both rise and set positions are displaced towards the north in summer, and towards the south for the winter track.
- On the southern hemisphere the south is to the left, the Sun rises in the east (near arrow), culminates in the north (to the right) while moving to the left and sets in the west (far arrow). Both rise and set positions are displaced towards the south in summer, and towards the north for the winter track.

The following special cases are depicted.

- On the equator the Sun is not overhead every day, as some people think. In fact that happens only on two days of the year, the equinoxes. The solstices are the dates that the Sun stays farthest away from the zenith, only reaching an altitude of 66.56° either to the north or the south. The only thing special about the equator is that all days of the year, solstices included, have roughly the same length of about 12 hours, so that it makes no sense to talk about summer and winter. Instead, tropical areas often have wet and dry seasons.
- The day arcs at 20° latitude. The Sun culminates at 46.56° altitude in winter and 93.44° altitude in summer. In this case an angle larger than 90° means that the culmination takes place at an altitude of 86.56° in the opposite cardinal direction. For example in the southern hemisphere, the Sun remains in the north during winter, but can reach over the zenith to the south in midsummer. Summer days are longer than winter days, but the difference is no more than two or three hours. The daily path of the Sun is steep at the horizon the whole year round, resulting in a twilight of only about one hour.
- The day arcs at 50° latitude. The winter Sun does not rise more than 16.56° above the horizon at midday, and 63.44° in summer above the same horizon direction. The difference in the length of the day between summer and winter is striking. Likewise is the difference in direction of sunrise and sunset. Also note the different steepness of the daily path of the Sun above the horizon in summer and winter. It is much shallower in winter. Therefore not only is the Sun not reaching as high, it also seems not to be in a hurry to do so. But conversely this means that in summer the Sun is not in a hurry to dip deeply below the horizon at night. At this latitude at midnight the summer sun is only 16.56° below the horizon, which means that *astronomical twilight* continues the whole night. This phenomenon is known as the *grey nights*, nights when it does not get dark enough for astronomers to do their observations. Above 60° latitude the Sun would be even closer to the horizon, only 6.56° away from it. Then *civil twilight* continues the whole night. This phenomenon is known as the *white nights*. And above 66° latitude, of course, one would get the midnight sun.
- The day arcs at 70° latitude. At local noon the winter Sun culminates at −3.44°, and the summer Sun at 43.44°. Said another way, during the winter the Sun does not rise above the horizon, it is the polar night. There will be still a strong twilight though. At local midnight the summer

Sun culminates at 3.44°, said another way, it does not set, it is the polar day.
- The day arcs at the pole. All the time the Sun is 23.44° above or below the horizon, depending on whether it is the summer or winter solstice. In the latter case, that is enough to not even have any twilight. All directions are north at the South Pole and south at the North pole. There is also no south at the South Pole, no north at the North Pole, and neither east nor west is discernible at either pole.

Due to atmospheric refraction, the Sun may already appear above the horizon when the real, geometric Sun is still below it.

## [edit] Cultural aspects

Many cultures celebrate various combinations of the winter and summer solstices, the equinoxes, and the midpoints between them, leading to various holidays arising around these events. For the winter solstice, Christmas is the most popular holiday to have arisen. In addition, Yalda, Saturnalia, Karachun, Hanukkah, Kwanzaa and Yule (see winter solstice celebration for more) are also celebrated around this time. For the summer solstice, Christian Catholic cultures and Nordic Christian Protestant cultures celebrate the feast of St. John from June 23 to June 24 (see St. John's Eve, Ivan Kupala Day, Midsummer), while the Wiccan culture observes Litha. For the vernal (spring) equinox, several spring-time festivals are celebrated, such as the observance in Judaism of Passover. The autumnal equinox has also given rise to various holidays, such as the Jewish holiday of Sukkot. At the midpoints between these four solar events, cross-quarter days are celebrated.

In most cultures the solstices and equinoxes also determine the midpoint of the seasons, which can be seen in the celebrations called midsummer and midwinter. Along this vein, the Japanese celebrate the start of each season with an occurrence known as Setsubun.

## [edit] See also

- Equinox - when the Sun can be found directly above the equator.
- Observation of the solstice by amateurs
- Winter Solstice Celebration
- Summer Solstice Celebration

## [edit] External links

- The seasons begin at the time of the solstice or equinox (from the Bad Astronomer)
- Solstice does not signal season's start? (from The Straight Dope)
- Earth's Seasons, Equinoxes, Solstices, Perihelion, and Aphelion, 1992-2020 (from the United States Naval Observatory's Astronomical Applications Department)
- Plot that shows how the date of the summer solstice shifts through the Gregorian calendar
- Wolfram Research solstice explanation
- Winter Solstice (in Celtic mythology)
- Solstice Dates and Times
- Solstice, Equinox & Cross-Quarter Moments for 2006 and other years, for several timezones
- Calculation of Length of Day (Formulas and Graphs)
- Calculate the Time of Solstices in Excel, CAD or your other programs. The Sun API is free and extremely accurate. For Windows Computers.
- Collaborative art project. Collaborative art project of summer solastic to show worlds sunrise and sunset photos of 21st June 2006
- Observe/Determine the solstice in your own back yard.
- Video of Winter Solstice Celebration at Stonehenge



Categories: Solar System | Calendars | Astrodynamics | Astrological factors | Celestial mechanics | Spherical astronomy | Winter holidays | June observances | December observances | Astronomical events

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