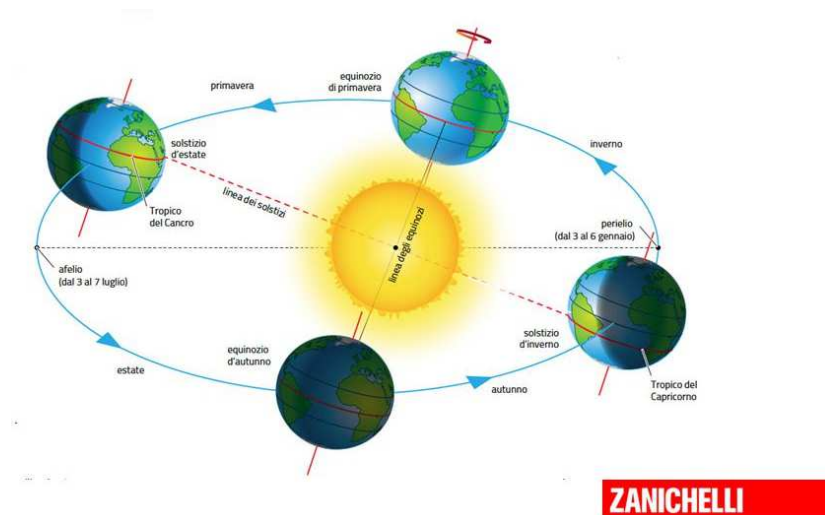


Curious facts about summer

If someone asks you “When does summer begin?”, very probably you would answer that it begins on the summer solstice, which this year falls on 21 June. Yet a meteorologist might say that it had already begun some time earlier, and that is on 1 June. Who is right? Well, both answers are correct, because there is not just one definition of summer. Indeed, we talk of a meteorological summer when basing the seasons on temperatures: the **meteorological summer** coincides with the hottest quarter of the year, which at our latitudes corresponds to the months of June, July and August. If, on the contrary, we are referring to the position of Earth as compared to the Sun, then we talk about the **astronomical summer**, which begins with the summer solstice and ends with the autumn equinox. This year, the astronomical summer will begin in the northern hemisphere on Friday 21 June, 15.54 UTC (coordinated universal time), when it will be 17.54 in Italy. Precisely at this time, the Sun will climb to the highest point above the horizon and the hours of light each day will increase to the maximum. From 22 June, the Sun’s height will once again move increasingly southwards, and days, which up to that date had gradually lengthened, will once again begin to shorten up until 22 December, the winter solstice which, at our latitudes (northern hemisphere) is the shortest day of the year, and the beginning of the astronomical winter. All this passing through the autumn equinox, which falls on 23 September, the day when night and day last the same number of hours. The opposite occurs in the southern hemisphere: in fact, the cycle of seasons in one hemisphere is opposite to that of the other, and therefore when it is summer in the northern hemisphere, it is winter in the southern hemisphere, and when it is spring in the northern hemisphere, it is autumn in the southern hemisphere.

Solstices, equinoxes and the alternation of the seasons

Solstices and equinoxes are due to the trajectory along which our planet orbits around the Sun. The axis of rotation of the Earth and the orbit plane in fact are not perpendicular, but cross each other forming an angle of around 23.27 degrees. This makes it seem that the Sun moves across the sky during the course of the year, causing day and night to have differing durations at different times of the year as well as giving rise to the alternation of the seasons.



Phelan, Pignocchino Le scienze naturali © Zanichelli editore 2015

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Spring begins with the spring equinox (which falls between 20 and 21 March) when day and night last the same number of hours, and ends with the summer solstice, which falls between 20 and 21 June, at the start of summer. This is the day on which the number of hours of light is highest, since the Sun is higher above the horizon. The autumn equinox occurs half way (22-23 September) towards winter, which begins on the darkest day of the year, and falls on 20 or 21 December. Seasons do not always have the same number of days since they begin and end in very definite astronomic moments, which vary from year to year. Every year, in fact, the solstices and equinoxes are delayed by around 6 hours: each year Earth takes a little over a year to rotate around the Sun, exactly 365 days and 6 hours. Therefore, to return to the same point of the orbit (in this case that of the solstice or the equinox) each year it takes about 6 hours more which, however, are recovered every 4 years with an extra day in a leap year. This is why the solstices and equinoxes do not always fall on the same day of the year.

Does the Sun stop moving?

The meaning of the word "solstice" derives from the Latin word "*solstitium*", a word composed of "*sol*" that is "sun" and "*sistere*" that is "to stop", and indicates, at astronomic level, the moment at which the sun, in its apparent journey along the ecliptic, reaches the point of maximum (in the case of the summer solstice) or minimum (winter solstice) declination. The etymological meaning refers to the fact that, on the day of the solstice, the sun stops climbing above the celestial equator, the projection into space of the earth's equator, and appears to stop still before beginning to drop down again. This is why, up to 21 June, the days get progressively longer while, as from this date, they immediately begin to get shorter until the winter solstice occurs.

Midnight sun and white nights

Midnight sun is a curious astronomical phenomenon characteristic of the polar regions. This phenomenon is due to the tilt of the Earth's axis of rotation which, at latitudes above $66^{\circ} 33'$, means that the sun never sets below the horizon, and therefore night never falls. Moreover, by rotating on its inclined axis, the Earth always exposes the North Pole towards the Sun.



Midnight sun in the Lofoten Islands, Norway

The phenomenon can be observed both in the Arctic and Antarctic area, in their respective summers. Depending on the latitude of observation, the sun may not set for several consecutive days. At the $66^{\circ} 33'$ latitude, night does not fall for almost two weeks. At North Cape (lat. $71^{\circ} 10'$) daylight remains for around 75 days, from mid-May to the end of July. At the Poles, the Sun does not set for 6 months.

Outside the Arctic Circle you can witness “white nights”. Even though the Sun is no longer visible on the horizon, refraction returns twilight, which lights up the cities and makes use of artificial light unnecessary. Likewise, in winter, it is dark at midday. In this case, again due to the tilt in the Earth’s axis of rotation, the Sun never rises above the horizon and it remains dark all day long.

Solstices and pagan rites

For millennia, the summer solstice has represented a special day for very many civilisations from the past. It is thought that one of the reasons leading to the building of the Stonehenge ring of standing stones was precisely that of paying homage to and studying solstices and equinoxes, and that the stones were arranged to be aligned with the first sun on the day of the summer solstice.



Stonehenge

It is thought to have been precisely the importance that the date had for pagan civilisations that led to choosing 24 June as the day on which St. John the Baptist was born (exactly six months from Jesus Christ, who was born in concomitance with the winter solstice), so as to incorporate the celebrations into the Christian faith. Additionally today, the solstice, as the midsummer festival (celebrated in the days that go from 21 to 25 June) is still an important festivity in very many European countries, like Sweden (where in the past there have been proposals to make it officially their National Day), Romania, Poland, Ukraine, United Kingdom, Spain, Portugal and Greece.