Celestial Sphere

Dandeswar Deka
Assistant Professor
Department of Physics
B. H. College, Howly.
E-mail: d.deka2010@rediffmail.com

Some basic definitions

Solar day :

A solar day is the time taken by the earth to complete one rotation on its axis.
1 solar day = 24 hours

Sidereal day :

The sidereal day is the time required for the Earth to rotate once relative to the background of the stars, i.e., the time between two observed passages of a star over the same meridian of longitude.

Length of sidereal day = 23 hours 56 minutes 4.091 seconds

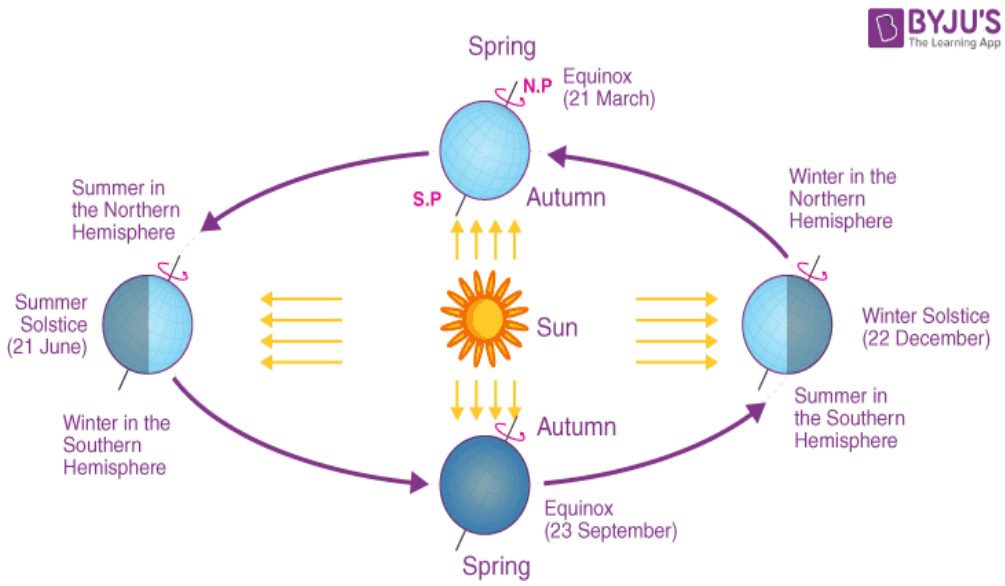
Why is sidereal day different from solar day?

A solar day is the time it takes for the Earth to rotate about its axis so that the Sun appears in the same position in the sky. The sidereal day is the time it takes for the Earth to complete one rotation about its axis with respect to the 'fixed' stars. The time at which a single star crosses the celestial meridian (i.e. directly overhead) on two consecutive nights is used to calculate the sidereal day. A sidereal day on Earth is marginally shorter than a solar day (≈ 4 min shorter). Since on Earth a day is generally described as 24 hours, the sidereal day is 4 minutes shorter. This means that a specific star will rise 4 minutes earlier every night.

Some basic definitions

Solstice and equinox :

An equinox occurs at the start of the spring and fall. The solstice occurs during the summer and the winter. Equinoxes occur on March 21 (Vernal equinox) and on September 23 (Autumnal equinox). Solstices occur on June 21(Summer Solstice) and on Dec 22 (Winter Solstice).



Some basic definitions

Astronomically, our planet's seasons change on four particular days each year, two solstices, one in June and one in December, and two equinoxes (one in March and one in September).

On Earth, there are two equinoxes every year : one around March 21 and another around September 22. Sometimes, the equinoxes are nicknamed the “vernal equinox” (spring equinox) and the “autumnal equinox” (fall equinox), although these have different dates in the Northern and Southern Hemispheres.

The June solstice is the summer solstice in the Northern Hemisphere and the winter solstice in the Southern Hemisphere. The December solstice is the winter solstice in the Northern Hemisphere and the summer solstice in the Southern hemisphere.

Earth's axial tilt is about 23.5 degrees. Due to this the June solstice marks the longest day in the north and the shortest day in the south of the equator. At equinoxes day and night become equal in both the hemispheres.

Some basic definitions

Solar time :

Solar time is a calculation of the passage of time based on the position of the Sun in the sky. The fundamental unit of solar time is the day, based on the synodic rotation period. There are two types of solar time- 1. Apparent solar time (Sundial) and 2. Mean solar time (Clock time).

Apparent solar time :

Apparent solar time or true solar time is based on the apparent motion of the actual Sun. It is based on the apparent solar day, the interval between two successive returns of the Sun to the local meridian. Apparent solar time can be crudely measured by a sundial.

Mean solar time :

Mean solar time, kept by most clocks and watches, is the solar time that would be measured by observation if the Sun traveled at a uniform apparent speed throughout the year rather than, as it actually does, at a slightly varying apparent speed that depends on the seasons.

Questions and answers

1. What is polaris?

Ans. Polaris is a star in the northern circumpolar constellation of Ursa Minor. It is designated as α Ursae Minoris and is commonly called the North Star or Pole Star. It is the brightest star in the constellation and is readily visible to the naked eye at night.

2. State the position of polaris.

Ans. Polaris is found very near the NCP. It is $58'$ away from the NCP.

3. Where will the celestial poles appear if you are on the earth's equator?

Ans. At the horizon.

4. If you are at the earth's north pole, then where will the NCP lie?

Ans. Directly overhead at the zenith.

Questions and answers

5. About which the stars appear to rotate?

Ans. About the NCP.

6. What are circumpolar stars?

Ans. A circumpolar star is a star that, as viewed from a given latitude on Earth, never sets below the horizon due to its apparent proximity to one of the celestial poles. Circumpolar stars are therefore visible from said location towards the nearest pole for the entire night on every night of the year.

7. How do size and distance of an object in CS are measured in terms of angles?

Ans. The size and distance of an object in CS are measured in terms of angles. For example, our fist makes an angle of 10^0 on our body. On the CS, the full moon is about $\frac{1}{2}^\circ$ wide.

Thank You