

# SKYTRACK

## Glossary of Terms

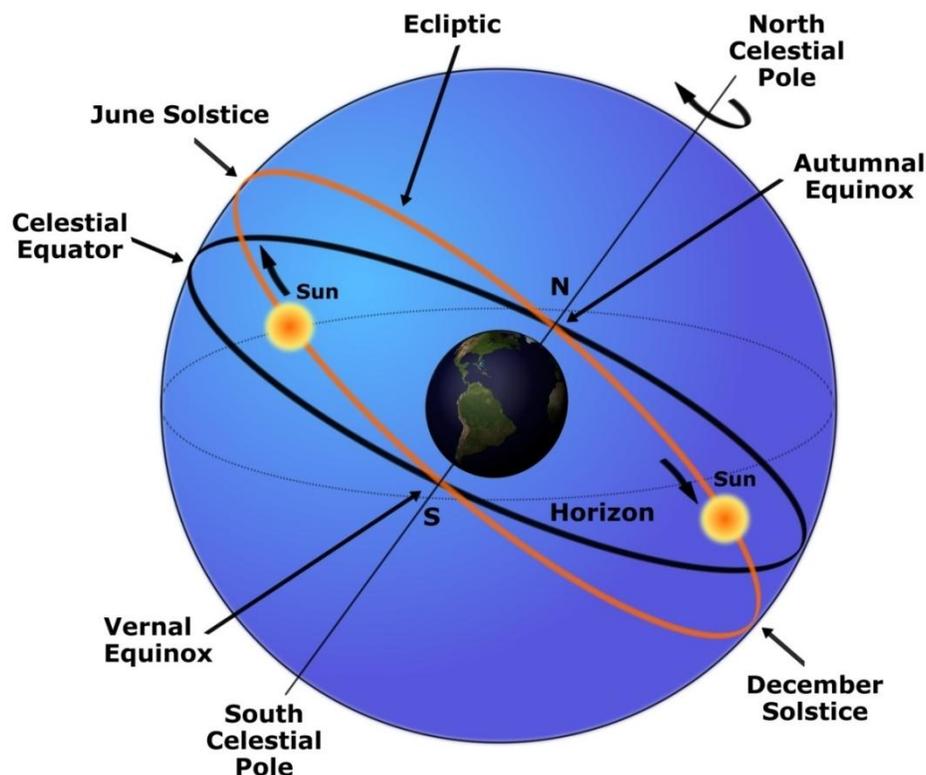
**Angular distance** – The angular separation between two objects in the sky as perceived by an observer, measured in angles. The angular separation between two celestial objects in the SKTRACK is given by an angle with a direction, e.g. Mercury 3.4° N of Venus; Antares 1.1° S of Moon; etc.

**Aphelion** – The point in the orbit of a planet or other celestial body where it is furthest from the Sun.

**Apogee** – The point in the orbit of the Moon or other satellite where it is furthest from the Earth.

**Celestial body** – Any object beyond the Earth and visible in the sky.

**Celestial Sphere** – An imaginary sphere of immense radius around the Earth which serves as the abstract backdrop for celestial bodies. All celestial bodies are assigned celestial coordinates (*right ascension* and *declination*), similar to longitude and latitude on Earth, to locate their positions on the surface of this imaginary sphere.



**Conjunction** – An occasion when two bodies in the Solar System (usually the Sun and a planet) line up as seen from the Earth.

**Crescent phase** – The collective term for the phases of a celestial body when it is less than 50% illuminated. It most often refers to the Moon, but is also applied to the inferior planets.

**Direct motion** – The movement of a celestial body from west to east - that is, in the same direction as that of the Earth around the Sun.

**Diurnal motion** – The apparent daily motion of the objects in the sky from east to west caused by the Earth moving from west to east.

**Eclipse of the Moon** (or **lunar eclipse**) – The event in which the Moon passes behind the Earth such that the Earth blocks the Sun's rays from striking the Moon. A **partial lunar eclipse** occurs when only a portion of the Moon enters the umbra. When the Moon travels completely into the Earth's umbra, one observes a **total lunar eclipse**. A **penumbral eclipse** occurs when the Moon passes through the Earth's penumbra. The shadow of the Earth in the penumbral region is not strong enough to cause a very obvious change in the illumination of the Moon. Hence penumbral eclipses are of only academic interest because they are subtle and hard to observe. The **umbral magnitude** is the fraction on the Moon's diameter immersed in the umbra at maximum lunar eclipse. For values greater than 1.0, it is a total lunar eclipse. For negative values, it is a penumbral eclipse.

**Eclipse of the Sun** (or **solar eclipse**) – The event in which the Moon passes in front of the Sun such that the Moon blocks the Sun's ray from striking the Earth. **Total solar eclipses** are visible from within the umbral shadow. **Partial solar eclipses** are visible from within the penumbral shadow. **Annular solar eclipse** is an eclipse of the Sun in which the Moon does not completely mask the Sun's light, resulting in a ring of light around the Moon at the peak of the eclipse. The **magnitude** of a solar eclipse is defined as the fraction of the Sun's diameter occulted by the Moon at maximum eclipse. The **obscuration** of a solar eclipse is defined as the fraction of the Sun's surface area occulted by the Moon at maximum eclipse.

**Ecliptic** – An imaginary line on the celestial sphere traced by the Sun as it moves in its yearly path through the sky. The **zodiac** is the zone of the celestial sphere  $8^\circ$  to each side of the ecliptic. The paths in the sky of the Sun, the Moon and the planets remain within this zone, all moving normally to the east (**direct motion**). Occasionally, a planet will present movement to the West (apparent **retrograde motion**).

**Elongation** – The measure of the angular distance between the Sun and the inferior planets in our sky. **Greatest elongation** is the time of greatest separation as seen from the Earth, and is a prime viewing period for the inferior planets. The greatest elongation of Venus is 46 degrees east (evening star) or west (morning star) of the Sun, while Mercury is 23 degrees east or west of the Sun.

**Equinox** – (a) The two points at which the Sun crosses the celestial equator. (b) The time of year when the Sun appears in the sky at the intersection of the ecliptic and the celestial equator. The **vernal equinox** (approx. March 21) marks the start of spring and the **autumnal equinox** (approx.

Sept. 20) marks the start of autumn in the Northern Hemisphere. At each of these points, the Sun rises due east and sets due west.

**Inferior conjunction** – The alignment of the Earth and an inferior planet (Mercury, Venus) on the same side of the Sun. During inferior conjunction, the planet would be lost in the Sun's glare. Obviously, a superior planet (Mars, Jupiter, Saturn, Uranus, Neptune or Pluto) cannot be at inferior conjunction.

**Inferior planet** – A planet located closer to the Sun than the Earth, namely Mercury and Venus.

**Meteor shower** – An annual display of several to hundreds of meteors visible every hour. A meteor shower occurs because the Earth passes through the debris left by a comet.

**Lunar phase (or Phases of the Moon)** – The appearance of the illuminated portion of the Moon as seen by an observer, usually on Earth. The lunar phases vary cyclically as the Moon orbits the Earth, according to the changing relative positions of the Earth, Moon and Sun. The four major moon phases are "NEW", "FIRST QUARTER", "FULL" and "LAST QUARTER".

**Phase** – The varying illuminated part of the Moon and planets caused by the relative locations of the object, the Earth, and the Sun.

**Occultation** – The passage of an object in front of another, blocking the light from the background object. For example, the Moon can occult a star or planet, or an asteroid can occult a star.

**Opposition** – The position of a superior planet when it is exactly 180 degrees east or west of the Sun in the sky, as seen from Earth; the planet is then best placed for observation.

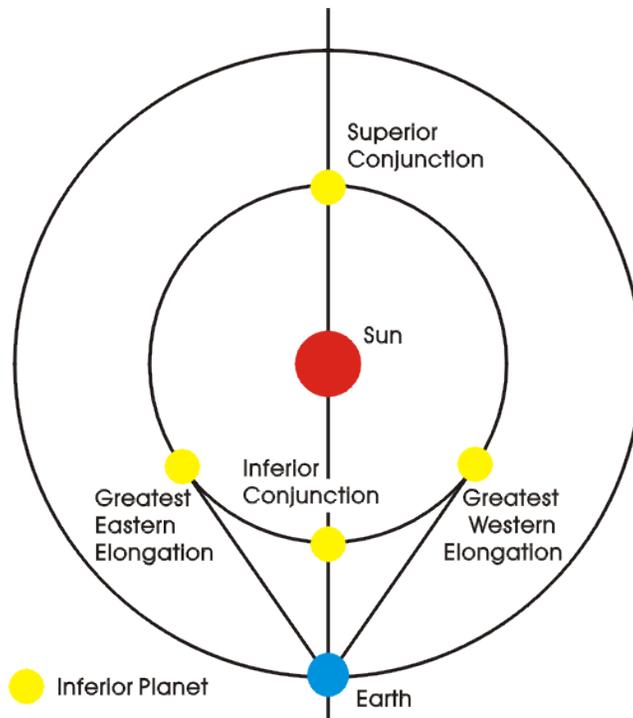
**Penumbra** – A partial shadow cast by the Earth or Moon that surrounds the umbra, or total shadow. During a total lunar eclipse, the Moon passes through the Earth's penumbra, then into the umbra where the Earth blocks the Sun's rays from striking the Moon. During a solar eclipse, the Earth passes through the Moon's shadow.

**Perigee** – The point in the orbit of the Moon or other satellite where it is closest to the Earth.

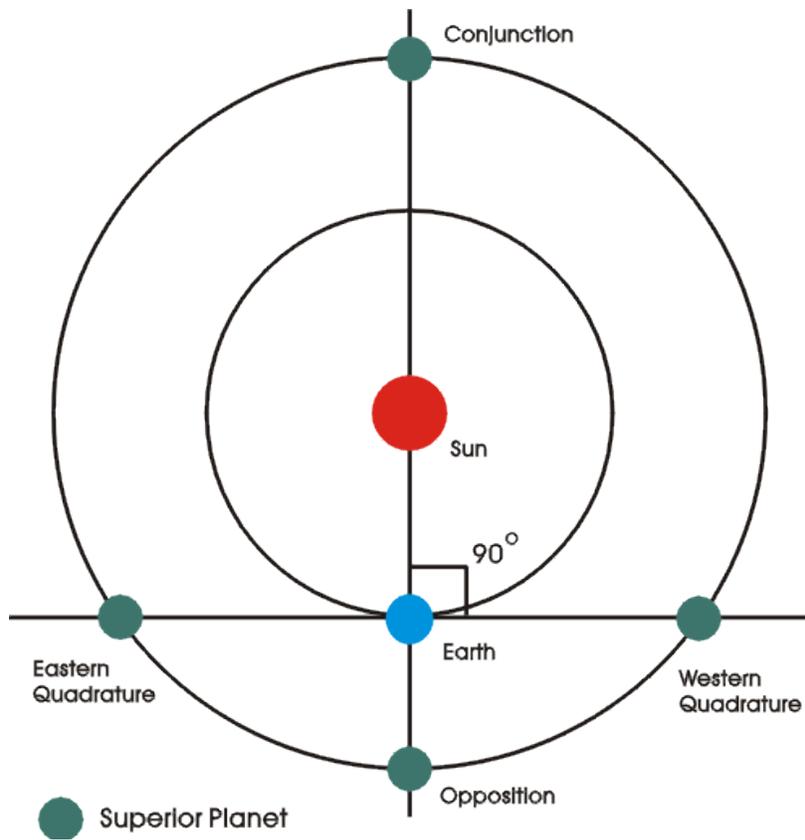
**Perihelion** – The point in the orbit of a planet or other celestial body where it is closest to the Sun.

**Planetary conjunction** – A close visual grouping of two or more planets in the night sky.

**Planetary phenomena** – Celestial phenomena seen from Earth due to different configurations of planets with respect to the Sun and the Earth. Configurations of inferior and superior planets are shown in the diagrams below:



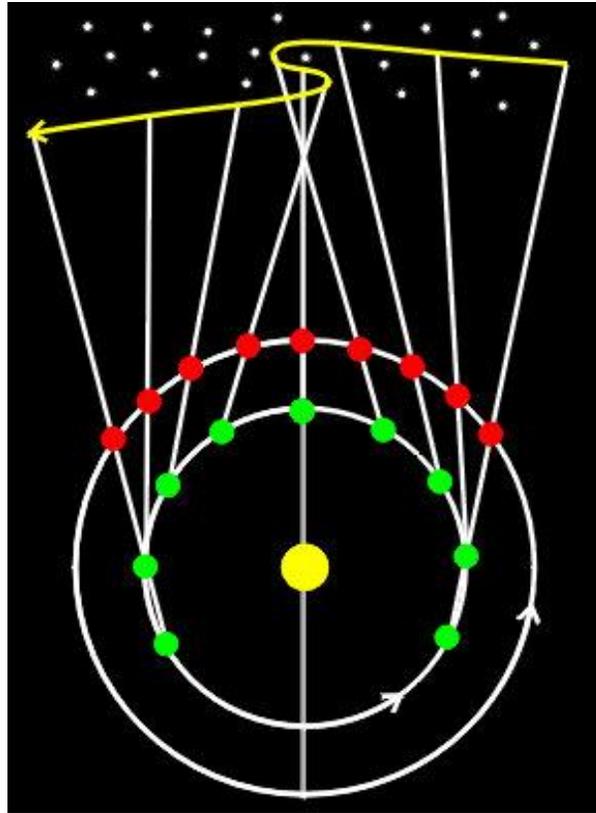
**Configurations of inferior planet**



**Configurations of superior planet**

**Radiant** – The point on the sky from where a shower of meteors appears to come.

**Retrograde motion** – The apparent periodic “backward” motion of a planet in the sky, from east to west, caused by the geometry between the Earth and planet. Normally planets progress west to east along the ecliptic. This occurs near the time of opposition (for an outer planet) or inferior conjunction (for an inner planet).



Occasionally, a planet will present movement to the West (apparent *retrograde motion*). In the case of an *exterior planet* (Mars, Jupiter, Saturn, Uranus, and Neptune), the Retrograde Motion is due to the parallax effect when the Earth catches up with, and passes the planet. In the case of an *interior planet* (Mercury and Venus), the Retrograde Motion is due to the parallax effect when being on the same side of the Sun as the Earth, the planet catches up with, and passes the Earth. The change from *direct* to *retrograde motion*, combined with the inclination of their orbits, causes the planets to make loops in the sky. These loops occur on each *sidereal period* for the interior planets, and on each *synodic period* for the exterior planets. At the turning points between direct and retrograde motion, when the planet appears to exhibit little or no motion relative to the background stars from our vantage point, the planet is said to be *stationary*.

**Sidereal period** – The time it takes for a planet (or other celestial body) to return to the same angular position (either in its orbit or its rotation) relative to the fixed stars.

**Solstice** – (a) The two points at which the Sun is at its greatest distance from the celestial equator. It happens twice each year, when the tilt of the Earth's axis is most inclined toward or away from the Sun, causing the Sun's apparent position in the sky to reach its northernmost or southernmost extreme. (b) Time of the year when the day is either shortest, or longest depending on where you are. Solstices occur within a few days of June 20 (*summer solstice*) and December 21 (*winter solstice*). The day of the summer solstice is the longest day of the year; the opposite is true for the winter solstice.

**Superior conjunction** – The position of a planet when it is on the opposite side of the Sun from Earth (thus making it invisible due to the Sun's glare).

**Superior planet** – Any planet beyond the orbit of the Earth in the Solar System

**Synodic period** – The length of time during which a body in the Solar System makes one orbit of the Sun relative to the Earth, i.e., returns to the same elongation. Because the Earth moves in its own orbit, the synodic period differs from the sidereal period, which is measured relative to the stars.

**Tropical year** – The length of time that the Sun, as viewed from the Earth, takes to return to the same position along the ecliptic, such as a solstice or equinox. The mean interval between two vernal equinoxes is 365.242 days long. The tropical year differs from the solar year by one part in about 26,000, since this is the period of the Earth's precession about its rotational axis combined with precession of the perihelion of the Earth's orbit.

**Universal time (UT)** – A time scale based on the mean solar day, defined to be as uniform as possible despite variations in the rotation of the Earth. UT is a modern continuation of the Greenwich Mean Time (GMT), i.e., the mean solar time on the meridian of Greenwich, England. When a precision of one second or better is needed, however, it is necessary to be more specific about the exact meaning of UT. In astronomical and navigational usage, UT often refers to a specific time called UT1, which is a measure of the rotation angle of the Earth as observed astronomically. It is affected by small variations in the rotation of the Earth, and can differ slightly from the civil time on the Greenwich meridian. Although their exact definitions differ, most readers can assume that Universal Time is equivalent to Greenwich Mean Time or GMT.

**Transit** – (a) The time at which a celestial object is highest in the sky. This is the best time to view the object. (b) When an object passes in front of another object. For example, transit of Mercury occurs when Planet Mercury passes in front of the Sun.

**Umbra** – A region of complete shadow cast by the Earth or Moon resulting from total obstruction of light.

**Zenith** – A point in the sky directly above an observer. The atmosphere is thinnest at the zenith, and thickest at the horizon. Thus astronomers prefer to observe an object when it is closest to the zenith.