

GLOSSARY

For a much fuller glossary see our book *Albedo to Zodiac*.

a.u. or AU: see **astronomical unit**.
albedo (Latin, “whiteness”): the fraction of incident light that a body reflects. The Moon is dark and has an albedo of .067 (reflects only 6.7% of light falling on it); Earth and Venus have albedos of .39 and .72.
altazimuth (or horizon) system: system of position based on the **altitude** and **azimuth** of a point in relation to the horizon. See *Astronomical Companion*, HORIZON SYSTEM.
altitude (Latin *altus*, “high”): angular distance of a point above (or, if negative, below) the horizon.
 See **eclipse**.
aphelion: outer point of an orbit around the Sun. See **perihelion**.
apogee: outer point of an orbit around the Earth. See **perigee**.
apparition of a planet: a time during which it becomes observable. For instance Mercury makes an evening apparition between its superior **conjunction** with the Sun and its following inferior conjunction; or “apparition” may refer to the central and best part of this time.
appulse: apparent closest approach of one body to another. Cf. **conjunction**.
ascending node: see **node**.
asterism: an apparent grouping of stars, such as the Big Dipper (officially only a part of the constellation Ursa Major).
asteroids (more official term: **minor planets**; in some European languages: **planetoids**): thousands of solid bodies much smaller than the major planets, in orbits with **direct** motion and usually low **eccentricity**. Most are in the “main belt” between the orbits of Mars and Jupiter, but some are farther out and some come in nearer than the Earth.
astrology should not be confused with astronomy, though they had a common origin. It is a body of traditions about how the relative positions of the Sun, Moon, and planets may affect life.
astronomical unit (AU), unit for measuring distances in the solar system: about 149,597,870 kilometers or 92,955,807 miles or 8.3 light-minutes or 500 light-seconds. It was originally intended to be the mean distance of the Earth from the Sun (semimajor axis of the Earth’s orbit); is now defined as the mean distance of a body with the period that Gauss assumed for the Earth. By this definition the actual semimajor axis of the Earth’s orbit is found to be 1.000,000,031 AU (a difference of less than 5 kilometers).
astronomy (from Greek *astêr* or *astron*, “star,” and *nomos*, “law”) is the study of every aspect of the material universe not confined to our planet, the Earth.
aurora borealis and **aurora australis**, “Northern Lights” and “Southern Lights” (Latin *aurora* actually means “dawnlight”): sheets and streamers of gentle colored light given off by the high atmosphere, mainly in irregular zones around the magnetic poles, when it is bombarded by energetic particles coming from the Sun.
axis: straight line through the center of something. A body rotates around its rotational axis (see **pole**).
azimuth (from Arabic *as-sumût*, “the ways” around the sky; plural of *as-samt* from which comes **zenith**): angular distance around the horizon, or parallel to it. Usually measured from the north point eastward (though sometimes in other ways). Thus the south point has an azimuth of 180°, and so does a star vertically above or below it. See **altazimuth**.
bolide: same as **fireball**, or one that explodes, perhaps with sound. (Greek *bolis*, “missile.”)
celestial: of the sky (Latin *caelum*), as opposed to **terrestrial**.
comets: small solar-system bodies distinguished from the asteroids by (generally) having more **eccentric** and **inclined** (sometimes **retrograde**) orbits, and by being composed of ice and dust, some of which, when a comet comes within about 3 AU of the Sun, is released to form a coma (cloudy halo) and tail.
 From *Ast. Cal.* 1995 onward we give the time of appulse instead—e.g. “Mercury passes 1.5° N.W. of Venus”—because they are observationally more interesting. An appulse may be so close that one body **occults** the other. See also **quasi-conjunction**. Note especially:
 —Conjunctions with the Moon: usually the statement (such as “Moon 1° north of Spica”) refers to the center of the Moon as seen from the *center* of the Earth. From a place on the Earth’s surface it may appear very different; e.g. from a place in the north hemisphere the Moon may even pass south of the star.
 —Conjunctions with the Sun are of two kinds: (1) **inferior conjunction**, when the body passes between Earth and Sun, and **superior conjunction**, when it passes on the far side of the Sun. Since only Mercury and Venus (and Earth-crossing asteroids and comets) can experience both kinds, the terms are usually only used for them; for all others, just “conjunction” is used and superior conjunction is implied.
constellation (Latin, from *cum*, “with, together,” and

stella, “star”): a grouping of stars into a picture; now more strictly one of the 88 regions of the sky, with various sizes and shapes but fixed boundaries. See *Ast. Compan.*, CONSTELLATIONS.

coordinates: numbers in a system specifying position, as measured from a zero-point or origin. In the system of Cartesian or **rectangular** coordinates, two lengths, *x* and *y* (“rightward” and “up”), give the 2-dimensional position of a point; adding a third, *z* (“away”), gives its 3-dimensional position. In a system of **polar** coordinates, the first two quantities are angles, a latitude and a longitude, together giving a direction; adding a distance gives 3-dimensional position. Among systems of polar coordinates are the **equatorial**, **ecliptic**, **galactic**, and **altazimuth**.

culminate: be highest in the sky. A star culminates when it **transits** across your **meridian**. See *Ast. Compan.*, HORIZON.

declination (dec. or δ): angular distance north or south of the celestial equator, measured in degrees, minutes and seconds, in the **equatorial** system; corresponding to latitude on the Earth.

descending node: see **node**.
dichotomy: the moment when an **inferior** planet is seen to be bisected straight down the middle by the line between dark and light (the **terminator**); so the appearance of the bright half is like a D. For cloudy Venus, the appearance of dichotomy does not happen when it should by geometry; so it is interesting to record the difference in days (which can be up to 10) between calculated and observed dichotomy.

direct or **prograde** motion: eastward motion. The planets appear to move eastward in the sky (from day to day) most of the time, and the Sun and Moon all the time. This is because all are actually revolving eastward—i.e. counterclockwise as seen from the north. But the planets sometimes go into **retrograde** motion.

EDT and **EST:** Eastern Daylight-Saving Time and Eastern Standard Time. (The former might be better called “Eastern Displaced Time.”) See *Ast. Compan.*, TIME.

eccentricity (Greek *ek*, “out,” *kentron*, “center”) describes the shape of **conic-section** curves. The circle has an eccentricity of 0; ellipses range from less **eccentric** (such as 0.1, a fat circle-like ellipse) to more **eccentric** (such as 0.9, a long skinny ellipse); a parabola has eccentricity exactly 1.0; hyperbolas have eccentricity of 1.1, 2.5, etc.

eclipse (Greek *ek-leipsis*, “a leaving-out”): (1) Of the Sun (**solar** eclipse), when the Moon’s shadow falls on the Earth, so that persons within the shadow see the Sun covered. Types are **partial**, **annular** (“ring-shaped”), **annular-total**, and **total**, though all begin and end with partial phases. (2) Of the Moon (**lunar** eclipse), when the Earth’s shadow falls on the Moon, so that persons on the night side of the Earth see the Moon darkened. Types are **penumbral**, **partial** (also having penumbral stages), and **total** (also having penumbral and partial stages). The shadow cast by any non-point source of light (such as the Sun) consists of a central **umbra** (hidden from the whole source) and a surrounding **penumbra** (hidden from a larger or smaller part of the source). The **magnitude** of an eclipse is the fraction of the diameter of Sun or Moon hidden at mid eclipse; it may be more than 1. (3) Of Jupiter’s or other satellites, when they enter the shadow of the planet. (4) Of an **eclipsing binary** star, when one star passes behind the other as seen from our viewpoint.

ecliptic: the plane of the Earth’s orbit; and the line tracing it on the sky, along which the Sun (and, less exactly, other solar-system bodies) appear to move. See *Ast. Compan.*, EARTH’S ORBIT.

How great the extreme elongations are depends on whether the planets are near aphelion or perihelion. Mercury’s greatest elongation varies from 18° to 28° because of its eccentric orbit; Venus’s is always 47° or 48° because of its nearly circular orbit. The outer planets, having orbits outside ours, can reach any elongation, but are also best seen near the greatest (180°), that is, near their **oppositions**. There is also the elongation (measured only in seconds) of a satellite from its planet, as seen by us.

ephemeris (from Greek *hêmera*, “day”; cf. the English word *ephemeral*, which means “transitory, lasting only a day”): a table of information by dates; for instance, a list of dates at 5-day intervals with, arranged in columns, a planet’s right ascension, declination, distance, magnitude, etc.

ephemeris time: a constant time, similar to **universal time** but free from the irregularities caused by changes in the rotation of the Earth. See *Ast. Compan.*, TIME.

epoch: the point in time for which a statement is intended to be true. Most star charts, catalogues, ephemerides, etc., are now given for the epoch of 2000: that is, positions are measured from where the zero-point (the **First Point of Aries**, ascending node of the ecliptic on the celestial equator) was at the beginning of this year.

equation of time: the difference between apparent solar time, e.g. the time when the Sun actually crosses the meridian, and mean solar time, e.g. the time when the fictitious “mean Sun,” moving at constant speed, crosses

it. Apparent time minus equation of time = mean time. See *Ast. Compan.*, TIME. The difference is caused by the elliptic shape of the Earth’s orbit.

equator: every rotating body has one. The plane of rotation of the Earth cuts the Earth’s surface at the terrestrial equator and is projected out into the sky to cut the celestial sphere as the **celestial equator**. This is a great circle, equidistant from the two celestial poles, and dividing the sky into northern and southern hemispheres. Thus for a place on the Earth’s equator, a line of stars along the sky’s equator passes exactly overhead. See **galactic equator**.

equatorial system: system of coordinates based on the rotation of the Earth. See *Ast. Compan.*, POSITION.

equinox: one of the 2 dates each year (about March 21 and September 23) when the Sun crosses the celestial equator. See *Ast. Compan.*, SEASONS. Also, the 2 points on the map of the sky where this happens: the points where the ecliptic crosses the equator. The complementary points are the 2 **solstices**. Because of **precession**, all these points move back (westward) along the ecliptic. The (current position of the) **March** or **spring** or **vernal equinox**, also called the **First Point of Aries**, is the origin or zero-point for both the equatorial and ecliptic systems of coordinates.

For this roughly coincides with the half of the sky visible at sunset, and includes all the points which will be overhead till midnight. The meridian overhead at midnight (i.e. opposite to the Sun) is the dividing line between evening and morning sky. At sunset, you are on the side of the Earth facing backward in the orbital direction around the Sun; so the evening sky is the view from the “stern” of the boat, morning sky from the “bow.”

evening star: any planet (not star) when it is in the evening sky. Usually applied to Mercury and Venus, which can never be very far east (left) of the Sun and must be seen around or soon after sunset; or to another bright planet that is low in the west near sunset. But, technically, the superior planets become evening stars when they pass their oppositions (crossing the meridian at midnight); for, after that, they gradually move down westward from night to night, till they reach the glare of sunset. “The Evening Star” usually means Venus.

fireball: a very bright meteor, now defined as one of **magnitude** —3 or above (brighter than Jupiter). See also **bolide**.

First Point of Aries: a name still used for the point which is the origin of the celestial coordinate systems, where the ecliptic crosses the equator northward, and where the Sun is at the March equinox (so that it can also be called the vernal equinox point). It was, in Greek times, at the west side of Aries; is now in Pisces; and will in the future move into Aquarius; see *Ast. Compan.*, PRECESSION. The opposite point in the sky is analogously though less commonly referred to as the **First Point of Libra** (and is now in Virgo).

First Quarter: the moment when the Moon is 90° eastward from the Sun (strictly, in ecliptic longitude rather than right ascension), its sunlit part appearing in the shape D (for south-hemisphere people: D backwards). Loosely, the Moon around this time.

Full Moon: the moment when the Moon is 180° around the sky from the Sun (strictly, in ecliptic longitude), thus presenting an almost totally sunlit face to us. It is about the same as the **opposition** of the Moon (which is in terms of right ascension).

galactic equator: the median plane of our rotating galaxy. It can be mapped as a great circle around our sky, running roughly along the middle of the Milky Way, but its exact position has been refined by determining the center of the galaxy, star motions, etc. At 90° from it are the north and south **galactic poles**, in Coma Berenices and Sculptor.

galaxy (Greek *gala*, “milk,” genitive *galaktos*): originally applied to the Milky Way; now to it and any other “island universe” of millions or billions of stars.

-gee, geo-, as in *perigee*, *geocentric*: of the Earth (Greek *gê* or *gaia*).

geocentric: Earth-centered; with a frame of reference in which the center of the Earth (as opposed to the Sun, or to a locality on the Earth’s surface) is the base or fixed point. Cf. **heliocentric** and **topocentric**.

great circle: any circle of maximum size on a sphere. It lies in a plane passing through the center of the sphere; divides the sphere into two hemispheres; connects points on the surface by the shortest distance; and appears as a straight line as seen from the center. The equator, ecliptic, horizon, galactic equator, all lines of right ascension, and all lines of longitude passing through the poles of other coordinate systems, are great circles; whereas all lines of declination and other kinds of latitude (except the equators) are **small circles**, appearing curved as we look out at them, and enclosing less than half the sky.

Greenwich (pronounced *Grènnich*) south-east of London, site of the Royal Observatory (the working observatory was moved to Herstmonceux Castle in Sussex and in 1989 to Cambridge). Because of the astronomical studies made here in the 18th century to help sailors and mapmakers determine longitude, the observatory was made 0° of the system of longitude on Earth; because of

this, the local time on this meridian (called **Greenwich Mean Time** and then **Universal Time**) became the agreed time for specifying astronomical events.

Gregorian calendar: see **Julian calendar**.

h, m, s: hour, minute and second of (1) time or (2) right ascension. An hour of r.a. corresponds (along the equator) to 15 degrees of arc (angle); therefore a "minute" and "second" of r.a. correspond to 15 minutes and 15 seconds of arc respectively; which is why the latter are abbreviated not with *m* and *s* but with ' and ''.

Hipparcos, "High Precision PARallax COLlecting Satellite," which from 1989 to 1993 measured the position and parallax (hence distance) of about 100,000 stars; from its results were published the Hipparcos and Tycho catalogues. Deliberately to be confused with Hipparchus (flourished 147-127 B.C.), greatest Greek astronomer, discoverer of precession and inventor of trigonometry.

heli-, as in *heliocentric*, *perihelion*: of the Sun (Greek *hēlios*).

illuminated extent: angular area of the visible sunlit disk of e.g. Venus; in some ways a better measure of observability than **magnitude**.

inclination of the orbit of a planet, asteroid, or comet: its angle to the plane of the **ecliptic**. If the inclination is more than 90°, the orbit is **retrograde**.

inferior conjunction of an inferior planet with the Sun: when it passes across the Sun-Earth line. It then becomes a **morning star**. Occasionally the planet actually **transits** in front of the Sun's disc.

inferior planets: Mercury and Venus, which are nearer than us to the Sun (literally "lower," as the Latin word means, in the gravitational field of the Sun); which therefore have two kinds of conjunction (inferior and superior), never have oppositions, but instead are best seen near their greatest elongations. Recently asteroids have been discovered which must also count as inferior planets since their average distances from the Sun are less than the Earth's.

Julian calendar : introduced by Julius Caesar in 46 B.C., and supplanted by our present Gregorian one from A.D. 1582 onward (at various dates in various countries). It has leap-days in every 4th year, which is too many. See *Ast. Compan.*, CALENDARS.

Julian Date: a count of time in days only, disregarding months and years; used in all serious astronomical calculation. The arbitrary starting-point is 4713 B.C. noon, so that e.g. 1990 Jan. 1 noon is J.D. 2447893.0. See *Ast. Compam.*, JULIAN DATES.

Last Quarter (or Third Quarter): when the Moon is 270° eastward from the Sun (in ecliptic longitude), its sunlit part appearing to us in the shape of a backward D (in the southern hemisphere, a frontward one).

latitude: angular height north or south of a plane of rotation or revolution. Specifically, there are **terrestrial** or geographical latitude; **declination**, which corresponds to it in the sky; **ecliptic latitude**, which is usually what just "latitude" means in astronomy; and galactic latitude, Saturnicentric latitude, etc. When a planet is at its **greatest latitude north or south**, it is at the point in its orbit which is farthest north (south) of the Earth's orbital plane. It may not appear to us at its farthest from the ecliptic, because it may at the same time be very distant from us.

libration: "balancing" motion of the Moon which allows us to see more than half of its surface.

limb: the edge or profile of the Sun, Moon, or any other body, where its surface passes away out of sight; contrast **terminator**.

limiting magnitude: the **magnitude** of the faintest star that can be seen. A measure of the sky's clarity.

longitude: angular distance around an axis of rotation or revolution. There is **terrestrial** longitude; **right ascension**, which is really what corresponds to it in the sky; ecliptic longitude, which is usually what "longitude" by itself means in astronomy; galactic longitude; **azimuth** around the horizon; the longitude of planets in their own orbits; etc.

lunar: of the Moon (Latin *luna*).

lunation: a cycle from New Moon to New Moon: about 29.53 days, varying between 29.27 and 29.83. E.W. Brown began the numbered series of them with lunation no. 1 on 1923 Jan. 16.

m (minute): see **h**.

Bolometric magnitude measures the energy at all wavelengths of the electromagnetic spectrum; **visual**, only in the visible wavelengths; **photographic** magnitudes are generally about .8 mag. less bright than visual ones.

main belt: see **asteroids**.

meridian: (1) A terrestrial meridian of longitude is any one of the lines of longitude from north to south pole on the Earth. (2) More important in astronomy, the (**celestial**) **meridian** is the one line passing over your head from the north to the south celestial pole. It passes through the zenith and also the south point on the horizon. A star when it reaches the meridian "souths" or "culminates," i.e. is at its highest in the sky and, in general, best placed for viewing. The Sun is on the meridian at mid-day. Hence the word: Latin *meridies* (earlier *medi-dies*) means literally "mid-day" and metaphorically also "south"; from it came *meridianus* and *meridionalis*, and French *midi* which also means "mid-day" or "south." The word *meridian* has been

extended to other lines of longitude, to the apex or climax of anything, and even to a noontime drink.

Milky Way: an irregular band of soft light all around the sky; in reality our own disc-shaped **galaxy** seen from inside.

morning sky, the half of the sky west of the Sun, and **morning star**, any planet when in it: see **evening sky**.

New Moon: the moment when the Moon is in conjunction with the Sun (strictly, having the same ecliptic longitude as it), passing north or south of it and sometimes eclipsing it. Popularly confused with **young Moon**.

node (Latin *nodus*, "knot") in astronomy means the place where two planes intersect. So, viewed from outside, there is a line, the **line of nodes**. But viewed from a place (such as the Earth) within one of the planes, it appears as two points on the sky: the **ascending node** where one plane cuts northward through the other, and the **descending node** where it returns southward. The node of a planet's orbital plane through the Earth's orbital plane appears to us as a point where the planet moves across the ecliptic in the sky.

obliquity: the angle at which the rotational plane of a body is inclined to the plane of its orbit. For instance it is 0° for Mercury; 25° for Mars; 98° for Uranus. For Earth is called the *obliquity of the ecliptic*; in other words it is the inclination of the celestial equator (plane of Earth's rotation) to the ecliptic (plane of Earth's revolution around the Sun). It is about 23.44° (but varies over long periods, in our time decreasing by about 0.013° a century).

occultation (Latin, "hiding"): when a body (most often the Moon) passes between us and another (a star or planet) and cuts off its light. It is a case of a very close **appulse** of the bodies. There is a pair of boundaries across the Earth within which the star is covered; along the boundaries themselves a **grazing** occultation takes place (the star often disappearing several times behind mountains along the Moon's limb). From timing and photometry of occultations a surprising range of discoveries is made.

old Moon: the Moon in the last few days of a lunation, just before becoming invisible as New Moon.

A fixed point such as a star has an opposition each year; the outer planets, almost every year; the asteroids, about 2 in 3 years; Mars about each 2nd year; Mercury and Venus have none, since they must remain on the sunward side of us.

orbit: path in space taken by a body (such as a planet or comet) moving around another body (such as the Sun). Its shape is one of the conic sections: an ellipse if the orbit is closed; a hyperbola if it is temporary and open, the comet's path merely bending around the Sun and then escaping back to space.

parallax: apparent displacement of something when seen from different positions (e.g. from your right and left eye). Parallax gives a means of measuring distance. The parallax of a star is *half* the angular distance it shifts when photographed at dates 6 months apart (i.e. from points as far apart as possible in Earth's orbit). For even the nearest stars these are such tiny angles (well below 1 second of arc) that the first was not measured till 1838. The unit of distance derived from parallax is the **parsec**.

parsec (short for *parallax-second*): the distance at which a star would have a parallax of 1 second of arc. It is 3.262633 light-years, or 30,856,780,000,000 kilometers.

See **eclipse**.

perigee: inner point of an orbit around the Earth. See **apogee**.

perihelion: inner point of an orbit around the Sun. See **aphelion**.

period: the time occupied by a cyclical process, such as the orbit of a planet or comet around the Sun.

periodic comet: one that is in an elliptical orbit bringing it back to perihelion in a relatively short time (by convention, less than 200 years). Most other comets which visit the inner solar system presumably will do so again but perhaps only after thousands of years; if the observable parts of their orbits are indistinguishable from parabolas, it is not possible to tell their periods.

phases of, especially, the Moon: stages in its changing appearance caused by the angle of the sunlight. **Phase (angle)** is the angle between our line of sight to a body and the sunlight falling on it. See *Ast. Compan.*, PHASES.

planet (Greek *planētēs*, "wanderer," plural *planētai*): one of the "stars" which move about, unlike the "fixed stars"; now known to be 9 major bodies, including the Earth, which are far nearer than the stars, orbit the Sun, and shine only by reflecting sunlight: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto. These are the **major planets**, as opposed to the thousands of **minor planets** or asteroids.

pole: either direction outward along the **axis** of any rotating body, at right angles to its **equator**. The axis of Earth cuts the Earth's surface at the north and south terrestrial poles, and is projected out to cut the sky at the north and south **celestial poles**, points among the stars which stay fixedly overhead at the respective poles of the Earth. All other coordinate systems (such as ecliptic, galactic) have their own poles.

precession: a large and subtle subject; see the *Ast. Compan.* section on it. It is a steady shift of the axis around which a body is rotating. The kind that most concerns us is the precession of the Earth's axis, because it compels us to keep redrawing our whole map of the sky; see **epoch**.

proper motion of a star: its change in position on the map of the sky, caused by its real motion in space. Even the largest proper motion, that of Barnard's star, is very small: 10.3" per year (the Moon's width in 177 years). Proper motion is given in catalogues as two components: in right ascension and in declination. E.g. for Dubhe (α UMa): +0.017s, +0.07" (the proper motion in r.a. appears rather large, but this is because the star is not far from the north pole). Proper motion combined with **radial velocity** gives the space motion of the star. That is, it gives it in relation to the sun, which is itself moving. An early clue to finding nearby stars was that they are liable to have large proper motion.

quadrature, east or west, of a superior planet: when it is 90° from the Sun as seen by us.

quarter-phases of the Moon (when it is ¼ or ¾ way around its cycle, but half sunlit): see **First** and **Last Quarter**.

radiant (point): point in the map of the sky from which meteors belonging to one stream, and traveling parallel to each other, appear to diverge as they come toward us. See *Ast. Compan.*, METEORS.

retrograde motion is westward. When we begin to overtake one of the superior planets on the inside, it appears to move backward in the sky, as against its normal **direct** motion eastward. This therefore happens around the time of the planet's opposition. When one of the inferior planets (Mercury and Venus) overtakes us on the inside, it too appears to move backward against the star background. This therefore happens around the time of the planet's inferior conjunction. The sequence of events is always: the planet slows; is at its greatest **elongation** eastward (if it is an inferior planet); stops moving eastward (is **stationary**); moves retrograde; passes through its **opposition** (superior planet) or **inferior conjunction** (inferior planet); again slows; is again stationary; resumes direct motion; is at greatest elongation westward (if an inferior planet) before starting to catch up with the Sun; after a much longer interval, reaches superior conjunction.

revolution: for example the Earth revolves, or orbits, around the Sun; contrast **rotation**.

right ascension (r.a. or **R.A.** or α): angular position around the sky as the Earth turns; usually measured not in 360 degrees but in 24 **hours**. Right ascension and **declination** make up the **equatorial** system of mapping the sky, and correspond to longitude and latitude on the Earth. See *Ast. Comp.*, POSITION.

rise: a body rises (into view), obviously, when it crosses the horizon upward. Actually it *appears* at the horizon when geometrically still 34' (minutes) below, because its light is refracted through this angle by the Earth's atmosphere (to this angle should be added half the width of the body, 16' for the Sun); so its rising into view is earlier by the 3 minutes or so it takes to climb this distance (longer if it is rising obliquely).

rotation (Latin *rota*, "wheel"): for example the Earth rotates, or spins, around its own axis; contrast **revolution**.

s (second): see **h**.

satellite (Latin *satelles*, "a sidekick," plural *satellites*): a small planetary body (**natural** satellite) or spacecraft (**artificial** satellite) in orbit around a planet. The Moon is the natural satellite of the Earth; hence natural satellites of other planets are sometimes loosely called "moons."

set: not quite so obvious a word as **rise**, which see for more details.

sidereal: of the stars (Latin *sidus* "star," plural *sidera*).

sidereal period: the period of something (e.g. of Jupiter's revolution around the Sun) with reference to space in general, not with reference to the way it is seen from the Earth (which is its **synodic** period). Among such periods are the **sidereal year** and **day** of the Earth, and the **sidereal month** of the Moon. See *Ast. Compan.*, TIME, TIME-UNITS.

sidereal time: time in a rotation of the Earth in the framework of space in general, without reference to the Sun. Sidereal time 0h is when the 0h line of right ascension is on the observer's meridian. See *Ast. Compan.*, TIME.

small circle: see **great circle**.

solar: of the Sun (Latin *sol*).

solar time: see **sidereal time**.

solstices, June and December: the two instants in the year when the Sun is farthest north of the celestial equator (June) and farthest south of it (December). Also the points in the sky where this occurs (on the ecliptic at right ascensions 6h and 18h). See the dates in the calendar, and **equinoxes**.

spectral types of stars: O, blue-white, hottest; B, blue-white; A, white; F, white-yellow; G, yellow (such as the Sun); K, orange; M, red, coolest.

sporadic meteors: those that do not belong to known showers.

stationary: when a planet or other moving body stops its apparent motion eastward (**direct**) in the sky and begins moving back westward (**retrograde**); or vice versa. It does not mean that the planet actually appears to halt: usually it is following a curve which is taking it north or south even at the moment when it ceases to move laterally. Also because of this curving, the exact date of becoming stationary **in right ascension** (which is often the one quoted in astronomical references) can be some days different from that of becoming stationary **in longitude**, that is, parallel to the ecliptic (which in some ways better characterizes the motion and is the one given in tables used by astrologers, for whom the ecliptic system is more important than the equatorial).

superior conjunction of an inferior planet (Mercury or Venus): when it passes on the far side of the Sun, and becomes an **evening star**. See more fully under **inferior conjunction**.

superior planets: Mars, most of the asteroids, Jupiter, Saturn, Uranus, Neptune and Pluto, whose orbits are farther out from the Sun than ours, so that they are literally "above" us (as the Latin word means) with respect to the Sun just as a cloud is above us with respect to the Earth. Contrast **inferior planets**.

synodic period of a body: the period between its returns to the same place in its orbit as *seen from the moving Earth*. Thus for Jupiter the synodic period is that between its conjunctions with the Sun (or oppositions). For the Moon it is the period from New to New (or Full to

Full, etc.). Contrast **sidereal**. (Greek *hodos*, "road"; *synodos*, "meeting, synod, conjunction.")

syzygy (from Greek, "yoking-together"): New or Full Moon.

terminator: the boundary between the sunlit and dark parts of the Moon or any other planetary body; the sunrise- and sunset-line. Contrast **limb**.

terrestrial: of the Earth (Latin *terra*), as opposed to **celestial**. But the **terrestrial planets** are the Earth and the other small hard planets, Mercury, Venus, Mars—and the Moon—as opposed to the large fluid **Jovian** ones.

Third Quarter: see **Last Quarter**.

tidal force is due to the *difference* between gravitational attraction exerted by e.g. the Moon on the nearer and farther sides of the Earth, causing them to stretch nearer and farther than their average positions. This is the force that causes a comet to break up when passing near to the Sun, or a body to elongate into a line when falling into a black hole.

topocentric: centered on a place (Greek *topos*), such as the locality where you are.

transit: the crossing of a body (1) over the **meridian**, or (2) in front of another body. Mercury and Venus at their **inferior conjunctions** sometimes transit across the face of the Sun (Mercury about 4 times in 33 years, Venus 4 times in 243 years). Jupiter's satellites and their shadows transit across the face of the planet.

twilight: the time (either before sunrise, **morning twi-**

light, or after sunset, **evening twilight**) when the Sun is not far below the horizon, so that the sky is not very dark. Civil or "car-headlight" twilight is defined as when the Sun is less than 6° down; for nautical twilight the limit is 12°; for astronomical twilight, 18°.

umbra (Latin, "shadow"): the total part of a shadow, from within which the light-source cannot be seen at all. If the light-source is a point, the whole shadow is umbra; but if the light-source has width, the umbra is surrounded by a **penumbra**.

Universal Time: a single agreed time for dating all astronomical events; it is equal to the local time at **Greenwich** on the zero meridian of longitude.

young Moon: when the Moon has just passed its New-Moon position and is becoming visible to the east of the Sun. Sometimes loosely called "New Moon," which can be confusing.

zenith (Arabic *samt ar-ra's*, "the way of the head"; see **azimuth**, which comes from the plural form of *samt*): the point straight over your head; its opposite is **nadir**. It is one of the points on the **meridian**.

zodiac: the band of 12 ancient constellations all round the sky (Pisces, Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Sagittarius, Capricornus, Aquarius) through which the **ecliptic** passes, so that the Sun, Moon and planets keep to these constellations. See the section on it in the *Ast. Compan*.