

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY

AN ASTRONOMICAL GLOSSARY

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ABSTRACT

At various times during the development of the GEODSS system it became clear that a common, technical vocabulary could be a useful thing. There are many precisely defined astronomical quantities one needs to intelligently discuss star catalogs, optical data reduction, orbital analysis, photometry, etc. Partially as an outgrowth of this need but mostly through the impetus of my forthcoming reference work, this Glossary was assembled. Its orientation is heavily toward astrometry rather than astronomy or astrophysics. Also it is frequently difficult to give precise and concise definitions. In some cases it is impossible to provide the precise meaning without complicated formulas and much discussion. Nevertheless, sometimes sacrificing clarity for brevity and with a minimum of mathematics, the following ~800 items are presented.

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A

- Al - The atomic time system of the U.S.N.O.
- AC - Abbreviation for the "Astrographic Catalogue"
- a huge, all sky, inhomogeneous, first photographic, 19th century effort.
- AGK1 - Abbreviation for the first in the Astronomischen Gesellschaft series of photographic catalogs north of $\delta = -2^\circ$ and complete to $m_{pg} = 9^m$.
- AGK2 - Abbreviation for the second of the AG catalogs; 180,000 stars.
- AGK2A - Abbreviation for the reference catalog of the AGK2; 13,747 stars.
- AGK3 - Abbreviation for the third of the AG catalogs; includes proper motions.
- AGK3R - Abbreviation for the reference catalog of the AGK3; 21,499 stars.
- APFS - Abbreviation for "The Apparent Places of Fundamental Stars" which is published yearly and includes all of the FK4 stars.
- A star - A bluish star such as Sirius or Vega showing strong hydrogen lines in its spectrum. Lines from singly ionized magnesium, silicon, iron, titanium, and calcium are also present. Surface temperatures range from 7,500 to 11,000°K.

Aberration - A defect in the formation of a perfect image by an optical system. Some common ones are spherical aberration, coma, distortion, astigmatism, and chromatic aberration.

Aberration of Light - The displacement of the position of an object due to the finite speed of light.

Aberrational Day Numbers - The Besselian Day Numbers denoted by C and D.

Aberrational Ellipse - The locus of points on the celestial sphere occupied by a star during the annual revolution of the Earth about the Sun due to annual aberration.

Absolute Catalog - A catalog of stellar positions obtained by the direct determination of the coordinate axes simultaneously with the positions of the stars.

Absolute Magnitude - For an extra-solar system object the value of its apparent magnitude for a distance of 10 pc. For a solar system object the value of its apparent magnitude for a geocentric distance of 1 A.U., a heliocentric distance of 1 A.U., and a phase angle of 0° .

Acceleration of the Equinox - The excess of $3^m56^s.6$ of the length of a mean solar day over the length of a mean sidereal day.

Acceleration of the Fixed Stars - The same as the acceleration of the equinox.

Airglow - The light caused by fluorescence in the Earth's atmosphere.

Air Mass - A measure of the path length through the atmosphere. For zenith distances less than 75° it is roughly proportional to the secant of the zenith distance.

Albedo - That fraction of the total amount of light incident on a surface which is reflected from it.

Almanac - A listing of astronomical events with their times of occurrence.

Almucantars - The small circles parallel to the astronomical horizon. They are also known as the parallels of latitude.

Altitude - The angular distance from the astronomical horizon to the point in question measured along the vertical circle through this point. The complement of the zenith distance.

Angle of Refraction - The difference between the zenith distance unaffected by astronomical refraction (z) and the refracted zenith distance (ζ). In a plane parallel atmosphere $\sin z = n \sin \zeta$ where n is the index of refraction so

$$R = z - \zeta \approx (n - 1) \tan \zeta.$$

Angle of the Vertical - The difference between the geodetic (ϕ) and geocentric (ϕ') latitudes; $\phi - \phi'$.

Angstrom - The unit of length ($= 10^{-8}$ cm) frequently used to express the wavelengths of visible (~ 4000 - 7000 \AA) spectral lines in stellar spectra.

Angular Momentum - The vector cross product of the location and the linear momentum. Its time rate of change is the net torque.

Annual - Yearly.

Annual Aberration - The component of stellar aberration due to the combination of the orbital motion of the Earth and the solar system barycentric motion of the Sun.

Annual Parallax - The angular displacement between the geometric projections of the directions of a celestial object as seen from the center of the Earth and the center of the Sun. If π is a star's annual parallax, r its heliocentric

distance, and a the semi-major axis of the Earth's orbit, then $\sin \pi = a/r$.

Annual Variations - The annual changes in right ascension and declination due to the combined effects of general precession and proper motion.

Annular Eclipse - An eclipse of the Sun by the Moon wherein the apparent solar disc is larger than the apparent lunar disc.

Anomalistic Month - The time interval between two successive perigee passages of the Moon; $27^{\text{d}}13^{\text{h}}18^{\text{m}}33^{\text{s}}$.

Anomalistic Year - The time interval between two successive perihelion passages of the Earth; $365^{\text{d}}06^{\text{h}}13^{\text{m}}53^{\text{s}}$.

Antapex - That point on the celestial sphere directly opposite the apex.

Antarctic Circle - The parallel of latitude on the Earth's surface whose south polar distance is approximately the obliquity of the ecliptic ($23^{\circ}27'$).

Aperture - The effective diameter of the primary mirror or lens of a telescope.

Aperture Efficiency - The square of the ratio of the effective diameter (i.e., after corrections for blockage, etc.) to the geometrical diameter of a telescope.

Aperture Ratio - The ratio of the aperture of a telescope to its focal length.

Apex - That point on the celestial sphere in the direction of motion.

Aphelion - The point in a heliocentric orbit when the heliocentric distance is a maximum.

Aplanatic System - A system of three lenses which together correct for coma, chromatic aberration, and spherical aberration.

Apoastron - That point in the orbit of a celestial object when it is furthest from the primary.

Apogee - The point in a geocentric orbit when the geocentric distance is a maximum.

Apparent Diameter - The diameter of a celestial object as perceived by the observer. It depends on the object-observer distance; see semidiameter.

Apparent Horizon - The projection of the local topographic boundary onto the celestial sphere.

Apparent Magnitude - A logarithmic measure of the luminosity of a celestial object with algebraically increasing magnitude indicating an apparently fainter object. The naked-eye stars have apparent magnitudes between -1 and $+6^m$. The apparent magnitude of the Sun is $\sim -23^m.7$, that of the faintest stars we can photograph $\sim 22^m$.

Apparent Noon - The instant when the Sun culminates.

Apparent Place or Position - That point on the celestial sphere at which a celestial object would be seen from the center of the Earth. It incorporates corrections to the mean place for general precession, proper motion, nutation, annual aberration (circular and e-terms), annual parallax, orbital motion, and planetary aberration. The reference system is the true equator and equinox of date.

Apparent Rising - That instant of time when the object is in the East and the geometric zenith distance is equal to 90° plus the horizontal refraction plus the semidiameter minus the parallax.

Apparent Setting - That instant of time when the object is in the West and the geometric zenith distance is equal to 90° plus the horizontal refraction plus the semidiameter minus the parallax.

Apparent Sidereal Day - The time interval between two successive upper transits of the true equinox of date.

Apparent Sidereal Time - The measure of time defined by the diurnal motion of the true equinox; the hour angle of the true equinox.

Apparent Solar Day - The time interval between two successive upper transits of the Sun.

Apparent Solar Time - The measure of time defined by the motion of the Sun in hour angle; the hour angle of the Sun plus 12^h.

Apparition - The time interval during which a celestial object is visible.

Appulse - The apparent closest angular approach of a star to a solar system object.

Apsides - Those points in an orbit when the distance to the primary is an extremum (i.e., apoastron and periastron).

Arctic Circle - The parallel of latitude on the Earth's surface whose north polar distance is approximately the obliquity of the ecliptic (23°27').

Argument of Periastron - The angle, measured in the plane of the orbit, from the ascending node to the periastron point. Analogously for the argument of perigee or perihelion.

Artificial Satellite - Any man-made object launched into orbit.

Ascending Node - That intersection of the orbital plane with the reference plane where the latitudinal coordinate is increasing.

Ashen Light - A faint glow from the dark side of Venus when it is in a crescent phase.

Asteroid - One of the several tens of thousands of small bodies in the solar system. The majority are in a belt between Mars and Jupiter.

Astrograph - A wide field camera especially used for the photographic determination of the position of celestial objects.

Astrographic Place or Position - The astrometric place minus the e-terms of aberration.

Astrolabe - A device for determining the positions of stars by observing their transits at a fixed altitude, usually 60° .

Astrometric Place or Position - The apparent place minus the circular component of annual aberration. It is used in the reduction of photographic observations of Pluto, Ceres, Juno, Vesta, and Pallas.

Astrometry - The study and determination of the positions, distances, and motions of the stars and principal members of the solar system.

Astronomical Coordinates - A coordinate system (of astronomical latitude and astronomical longitude) on the Earth's surface which is independent of the figure and size of the Earth.

Astronomical Equator - The locus of points on the Earth's surface with an astronomical latitude of 0° .

Astronomical Horizon - That great circle on the celestial sphere whose poles are the astronomical zenith and nadir; that great circle on the celestial sphere whose normal is given by the direction of the local gravitational field. The fundamental circle of the horizon system of coordinates.

Astronomical Latitude - The complement of the acute angle between the astronomical vertical and the Earth's axis of rotation.

Astronomical Longitude - The dihedral angle between the plane of the celestial meridian and the plane of the celestial meridian through the site of the Airy transit circle at the Old Royal Greenwich Observatory; it is reckoned positive to the East.

Astronomical Meridian - The locus of points on the Earth's surface all of which have the same astronomical longitude.

Astronomical Refraction - The value of the integral

$$\int_1^{\mu_0} \left[\left(\frac{r\mu}{r_0\mu_0} \csc z_0 \right)^2 - 1 \right]^{-1/2} d\mu \text{ where } \mu = \mu(r) \text{ is}$$

the index of refraction of the atmosphere, r is the geocentric distance, z is the zenith

distance measured from the geocentric zenith, and the zero subscript indicates quantities evaluated at the observer's location. The displacement of the geometric position of a point on the celestial sphere due to refraction in the Earth's atmosphere.

Astronomical Triangle - The spherical triangle on the celestial sphere whose vertices are at the point in question, the astronomical zenith, and the elevated celestial pole.

Astronomical Twilight - The interval of time between sunrise or sunset and the instant when the Sun's depression is 18° (zenith distance = 108°).

Astronomical Unit - Almost the mean heliocentric distance of the Earth which is 1.00000023 A.U.; 1 A.U. = 1.495978×10^8 km = a light time of 499.0047 sec.

Astronomical Vertical - That line determined by the direction of the local gravitational field. This line intersects the celestial sphere in the astronomical zenith and nadir.

Astronomical Zenith - The overhead pole of the astronomical horizon; the intersection of the upward extension of the astronomical vertical with the celestial sphere.

Atmospheric Extinction - The combination of true absorption and scattering of light in the Earth's atmosphere which both diminishes and reddens the light from celestial objects. Its magnitude is roughly proportional to the secant of the zenith distance. The proportionality constant is called the atmospheric extinction per unit air mass.

Atomic Time - Any of the systems of time based on the stability of an atomic transition, especially the ground state hyperfine transition of Ce^{133} .

Attitude - The orientation of a rocket or artificial satellite with respect to some reference plane.

Augmentation of the Semidiameter - The difference between the topocentric and geocentric semidiameter. To first-order $\Delta S = \pi S \cos z$ where π is the equatorial horizontal parallax, S is the semidiameter, and z is the zenith distance.

Autumnal Equinox - The point of intersection of the celestial equator and the ecliptic where the Sun is moving southward (declination decreasing).

Azimuth - The angular distance measured from the south, positive to the west, along the astronomical horizon to the intersection of the astronomical horizon with the vertical circle through the point in question. Frequently measured from the north positive to the east.

B

B Magnitude - The blue magnitude in the UBV system centered at 4400Å.

B Star - A bluish star such as Rigel or Spica showing strong lines of neutral helium in its spectrum. Lines from singly ionized oxygen and magnesium and singly and doubly ionized silicon are also present. Surface temperatures range from 11,000 to 25,000°K.

Background Noise - The general term for all the extraneous sources of signals in a measuring system. Not necessarily due to a physical background source.

Bailey's Beads - Small "beads" of sunlight seen passing through valleys along the limb of the Moon at the instants preceding the commencement or termination of totality during a total solar eclipse.

Baker-Nunn Camera - A special Schmidt camera devised for obtaining positions of artificial satellites.

Balmer Discontinuity or Jump - The sudden decrease in the intensity of the continuous part of stellar spectra at the limit of the hydrogen Balmer series.

Bandwidth - The width of that portion of the electromagnetic spectrum transmitted by or accepted by a device.

Barycentric - Referred to the center of mass of a system.

Besselian Day Numbers - The five quantities denoted by A, B, C, D, and E used in conjunction with Besselian star constants for the reduction of a star's mean catalog place to its apparent place.

Besselian Solar Year - The time interval between successive instants when the mean longitude of the Sun, affected by annual aberration, is exactly $18^{\text{h}}40^{\text{m}}$. Very nearly equal ($0^{\text{s}}.148\text{T}$ shorter) to a tropical year always commencing near January 1.

Besselian Star Constants - The eight quantities denoted by a, b, c, d (for right ascension) and a', b', c', d' (for declination) used in conjunction with Besselian Day Numbers for the reduction of a star's mean catalog place to its apparent place.

Binary Star - General term for a two-component stellar system.

Bolometric Correction - The correction, in magnitudes, required to the absolute V magnitude to indicate the total energy output of a light source. It is necessarily non-positive.

Bolometric Magnitude - A logarithmic measure of the total energy output of a celestial object when its distance is 10 pc.

C

CPC - Abbreviation for "The Cape Photographic Catalogue for 1950.0". Covers south of $\delta = -30^\circ$ with a density of 10 stars/square degree between $m_{pg} = 7^m$ and 10^m .

Calendar - An arrangement of days into larger groupings usually based on a lunar or solar period. The currently used Gregorian calendar was introduced in 1582.

Cardinal Points - The four principal points of the compass - north and south, east and west. These points are, respectively, the intersections (poles) of the celestial meridian (prime vertical) and prime vertical (celestial meridian) with the astronomical horizon.

Cassegrain Focus - An optical arrangement wherein light is focused and reflected by the primary mirror (parabolic concave) at the base of the telescope tube back towards a small secondary mirror (hyperbolic convex) which then reflects it through a small central hole in the primary, focusing it external to the telescope.

Cassini's Division - A dark region between Saturn's brightest two rings.

Cassini's Laws - Three rules governing the observed behavior of the Moon's revolution and rotation. They are (i) the descending node of the lunar equator on the ecliptic is coincident with the ascending node of its orbit, (ii) the inclination of the lunar equator with respect to the ecliptic is a constant, and (iii) the mean lunar rotation period is equal to the average sidereal period of revolution.

Catalog Mean Place or Position - That point on the celestial sphere at which an object would be seen from the solar system barycenter affected by the e-terms of aberration. The reference system is the mean and equator and equinox at the beginning of a Besselian solar year (in modern catalogs 1900.0, 1950.0, 1975.0, or 2000.0).

Catalog Place or Position - See catalog mean place.

Cauchy's Dispersion Formula - An approximate, empirical formula for the index of refraction of air as a function of wavelength.

Celestial Coordinate System - A coordinate system on the celestial sphere such as the horizon system, the equatorial system, or the ecliptic system.

Celestial Equator - The great circle which is the projection of the Earth's geographical equator of rotation onto the celestial sphere. Its poles are the North and South Celestial Poles. The fundamental circle of the equatorial system of coordinates.

Celestial Latitude and Longitude - See ecliptic latitude and ecliptic longitude.

Celestial Mechanics - That branch of mechanics that deals with the motions of celestial objects. The principal force is (Newtonian) gravity.

Celestial Meridian - That vertical circle through the elevated celestial pole. It also passes through the other celestial pole, the astronomical zenith, and the nadir. It orthogonally intersects the astronomical horizon in the North and South points.

Celestial Object - Any object external to the Earth including the Sun, planets, Moon, asteroids, other stars, galaxies, nebulae, etc.

Celestial Poles - The poles of the celestial equator; the intersection of the prolongation of the line through the geographical poles of rotation with the celestial sphere.

Celestial Sphere - The apparent spherical surface on which the planets, stars, galaxies, etc. appear to be projected.

Chandler Wobble - A periodic (416 - 433^d) variation of the geographic poles of rotation with an amplitude of $\lesssim 15\text{m}$.

Chromatic Aberration - An aberration of optical systems whereby light of different wavelengths is focused at different places.

Circle of Perpetual Apparition - The small circle whose polar distance from the elevated celestial pole is equal to the absolute value of the observer's astronomical latitude (ϕ). Stars near this pole with declinations δ satisfying $|\delta| > |\phi|$ never set.

Circle of Perpetual Occultation - The small circle whose polar distance from the elevated celestial pole is equal to 180° minus the absolute value of the observer's astronomical latitude (ϕ). Stars near the invisible pole with declinations δ satisfying $|\delta| > |\phi|$ never rise.

Circle of Position - A small circle on the Earth's surface, centered on the substellar point, with a radius equal to the star's co-latitude as seen by the observer. The observer is somewhere on this circle.

Circles of Declination - The secondary system of great circles in the equatorial coordinate system fixed to the

celestial sphere. Each one passes through the poles of the celestial equator and the term is not used.

Circles of Latitude - The secondary system of great circles in the ecliptic coordinate system. Each one passes through the poles of the ecliptic.

Circumpolar Regions - The regions above and below the circles of perpetual apparition and occultation.

Cislunar - That region of interplanetary space between the Earth and the Moon's orbit.

Civil Time - The time system used to regulate daily life whose rate is that of Universal Time (mean solar time) and whose day begins at midnight.

Civil Twilight - The interval of time between sunrise or sunset and the instant when the Sun's depression is 6° (zenith distance = 96°).

Civil Year - In the Gregorian calendar 365.2425 mean solar days [= $(400 \times 365^d + 97 \text{ intercalary days})/400$].

Clock - A device consisting of a fixed frequency oscillator and a mechanism for displaying the cumulative number of such oscillations since a particular epoch.

Cluster of Galaxies - A large ($\gtrsim 10^2$) grouping of galaxies.

Co-latitude - The complement (i.e., 90° minus) the latitude.

Color Difference or Index - The difference between two magnitudes measured in two different wavelength regions. Usually the longer wavelength magnitude is subtracted from the shorter magnitude (e.g., B-V or U-B in the UBV system).

Color Term - The effect of color difference on the measurement of the position of a celestial object.

Coma - An aberration of optical systems whereby off-axis rays of light striking different parts of the objective do not come to focus in the same plane.

Comet - A celestial object in the solar system which exhibits a long tail or coma extending from the main body or nucleus upon a close approach to the Sun. Most comets are in nearly parabolic orbits.

Commensurate - That state of one quantity such that it can be equal to second quantity upon multiplication by a rational fraction.

Compilation Catalog - A catalog of stellar positions obtained by the judicious combination of (principally) absolute catalogs.

Complete Catalog - A catalog of stellar positions, proper motions, distances, and radial velocities.

Conjunction - That configuration of two celestial objects such that their longitudinal coordinates are equal such as an equatorial conjunction (equal right ascensions) or ecliptic conjunction (equal celestial longitudes).

Constant of (Annual) Aberration - The quantity $\kappa = 20''.49552$ which is equal to $(v/c) \text{cscl}''$ where v is the average speed of the Earth about the Sun and c is the speed of light in vacuo. In particular $v = 2\pi a / [P(1 - e^2)^{1/2}]$ where a is the semi-major axis of the Earth's orbit, e the eccentricity of the Earth's orbit, and P is the sidereal revolution period of the Earth.

Constant of Diurnal Aberration - The quantity $0''.3200 \rho \cos \phi'$ where ρ is the geocentric distance of the observer measured in units of the equatorial radius of the Earth (6378.140 km) and ϕ' is the observer's geocentric latitude. The numerical part is equal to $2\pi a \text{cscl}'' / (cP)$ where a is the equatorial radius of the Earth, P is its sidereal period of rotation, and c is the speed of light in vacuo.

Constant of Gravitation - The proportionality constant in Newton's Law of gravitation; $G = 6.672 \times 10^{-11} \text{ m}^3/\text{kg}/\text{sec}^2$.

Constant of Lunisolar Precession - The coefficient of the linear secular term in the expression for the (westward) displacement of the descending node of the celestial equator on the fixed ecliptic of epoch.

Constant of Mean Refraction - The proportionality constant in the approximate, small zenith distance, formula for the astronomical refraction formula; the ratio of the angle of refraction to the tangent of the zenith distance as the zenith distance $\rightarrow 0$. Approximately $1'$.

Constant of Nutation - The coefficient of $\cos \Omega_\zeta$ in the expression for the periodic change in the obliquity of the ecliptic (Ω_ζ is the mean longitude of the ascending node of the lunar orbit on the ecliptic); $9''2109$.

Constant of Precession - The coefficient of the linear secular term in the general precession in longitude; the product of the constant of lunisolar precession and $\sec \epsilon$ where ϵ is the obliquity of the ecliptic.

Constant of Solar Parallax - The angle given by \sin^{-1}
(a/A) where a is the semi-major axis of the
reference ellipsoid and A is 1 A.U.; 8".794148.

Constellation - A configuration of stars (sometimes
imaginatively) named for a particular object,
person, or animal.

Coordinated Universal Time - See UTC.

Correction for Light Time - The correction to the place
of an object due to the motion of an object
during the time light traveled between the
object and the observer.

Cosmic Light - The small contribution to the night sky
background due to extra-galactic sources.

Coude Focus - A configuration of two or more secondary
mirrors in a reflecting telescope whereby the
light is sent down the telescope's polar axis
and focused at a place separate from the
instrument's moving parts.

Counter glow - The same as the gegenschein.

Crescent Moon - A phase of the Moon when its elongation
is less than 90° and less than half of the
visible hemisphere is illuminated.

Culmination - That instant when a celestial object reaches
its greatest altitude.

D

Dark Current - The current that flows in a photoelectric device when it is capped (i.e., not illuminated).

Dawn - The twilight period preceding sunrise.

Declination - The angular distance from the celestial equator to the point in question measured along the hour circle through the point. It is reckoned positive (negative) north (south) of the celestial equator.

Declination Axis - The north-south axis of rotation for an equatorial mount.

Deflection of the Vertical - The angle between the astronomical vertical and the geodetic vertical.

Depression - The negative of the altitude when the zenith distance exceeds 90° .

Descending Node - That intersection of the orbital plane with the reference plane where the latitudinal coordinate is decreasing.

Diffraction - The bending or spreading of light when it passes the edge of an opaque body.

Diffraction Grating - A system of closely spaced slits (usually parallel and equidistant) which disperses the incoming light into its component parts.

Diffraction Limited - That state of an optical system such that the angular resolution is given by the effects of diffraction.

Diffuse Galactic Light - The small contribution to the night sky background due to non-resolved stars and scattered star light.

Dip of the Horizon - The angular distance of the visible horizon below the astronomical horizon.

Direct Motion - Motion about the primary in a counterclockwise fashion as seen from the North (e.g., West to East).

Distance - In the coordinate system of position angle and distance the angular distance between the reference object and the object of interest measured along the great circle passing through both objects.

Distance Modulus - The difference between the apparent and absolute magnitudes of a celestial object. It is reckoned in magnitudes and for extra-solar system objects it's also equal to $5 + 5 \log \pi$ where π is the object's annual parallax in seconds of arc.

Diurnal - Daily.

Diurnal Aberration - The component of stellar aberration due to the rotational motion of the Earth.

Diurnal Circle - The path traced out on the celestial sphere by a celestial object due to the diurnal rotation of the Earth. Because of the circumstances of observation, particularly refraction, parallax, and aberration, the path is not a perfect circle.

Diurnal Motion - The apparent westward motion of the celestial sphere due to the Earth's rotation.

Diurnal Parallax - The angular displacement between the geometric projections of the directions of a celestial object as seen by the observer and from the center of the Earth.

Doppler Effect - The variation in the apparent frequency of sound or light waves due to the relative motion of the source and the observer.

Draconic Month - The period of revolution of the Moon about the Earth with respect to the ascending node of the lunar orbit; $27^{\text{d}}05^{\text{h}}05^{\text{m}}36^{\text{s}}$.

Dusk - The twilight period following sunset.

Dynamical Flattening - The quantity $(C - A)/C$ where A and C are the equatorial and polar moments of inertia of the Earth.

Dynamical Libration - The departures of the actual rotation of the Moon from its mean rotation (as given by Cassini's Laws).

Dynamical Parallax - An estimate of a binary system's
annual parallax derived using Kepler's
third law.

E

E.T. - Abbreviation of Ephemeris Time.

E.T.0 - The ephemeris time system of the International
Lunar Ephemeris.

E.T.1 - A minor modification of E.T.0.

E.T.2 - A minor modification of E.T.0.

E-Terms of Aberration - The same as elliptic aberration.

Early Type Star - The hotter stars of spectral class
O, B, A, and F0 - F5.

Earthshine - Light reflected by Earth. It is visible
on the Moon when the Moon is near its New
Moon phase.

East Point - That point on the astronomical horizon 90°
(measured clockwise) from the North Point.
The Sun appears to rise at the East Point on
the equinoxes and the stars all appear to
rise in the East.

Eccentric Anomaly - The regularizing variable in the
two-body problem. E is related to the mean
anomaly by Kepler's equation.

Eccentric Latitude - The angle θ related to the
geocentric latitude (ϕ') and the geodetic
latitude (ϕ) via $\tan\theta = (1 - e^2)^{1/2} \tan\phi$
 $= \tan\phi' / (1 - e^2)^{1/2}$ where e is the
eccentricity of the reference ellipsoid.

- Eccentricity - The quantity $e = (1 - c^2/a^2)^{1/2}$ where
 a and c are the semi-major and semi-minor
 axes of the ellipse; the ratio of the distance
 from the center of an ellipse to its focus to
 the semi-major axis. The relationship between
 e and the flattening f is $e^2 = 2f - f^2$ ($f \geq 0$).
- Eclipse - The total or partial obscuration of light from
 a celestial body caused by its passage behind
 or into the shadow of another celestial object.
- Eclipse Limits - The maximum distance of the Sun or Moon
 from a node such that an eclipse is possible.
- Eclipse Path - The locus of points on the Earth's surface
 for the visibility of an eclipse.
- Eclipse Season - The period during a year when an eclipse
 of the Sun or the Moon is possible.
- Eclipse Year - The period of revolution of the Earth about
 the Sun with respect to the Moon's line of
 nodes; $346^d 14^h 52^m 52^s$.
- Ecliptic - That great circle on the celestial sphere
 whose plane is the instantaneous mean orbital
 plane of the Earth. The fundamental circle of
 the ecliptic system of coordinates.
- Ecliptic Coordinate System - The spherical coordinate system
 of distance, ecliptic latitude, and ecliptic

longitude. Geocentric, heliocentric, and solar system barycentric ecliptic systems are in use.

Ecliptic Latitude - The angular distance from the ecliptic to the point in question measured along the great circle through the ecliptic poles and the point in question.

Ecliptic Longitude - The angular distance measured from the vernal equinox, positive to the east, along the ecliptic to the intersection of the ecliptic with the great circle through the poles of the ecliptic and the point in question.

Ecliptic Polar Distance - The complement of ecliptic latitude.

Egress - The motion of a planet across the limb of the Sun at the end of a transit.

Elements of an Orbit - See orbital elements.

Elevation - The height of a point on the Earth's surface above the reference ellipsoid.

Elliptic Aberration - That part of annual aberration proportional to the eccentricity of the Earth's orbit.

Elliptical Galaxy - A galaxy seen in projection to have an elliptical shape and without dust or gas and composed of late-type stars.

Elongation - For a circumpolar star it is the instant when the star is farthest east or west of the pole in azimuth. For a solar system object it is the angle subtended at the Earth by the object-Sun arc of a great circle on the celestial sphere. If r is the heliocentric distance of the planet, R the geocentric distance of the Sun, and ρ the geocentric distance of the planet, then $\cos(\text{elongation}) = (\rho^2 + R^2 - r^2)/(2R\rho)$.

Emersion - The reappearance of one celestial body from behind a second celestial object at the completion of an eclipse or occultation.

Ephemeris - A list of (accurate) positions or locations of a celestial object as a function of time.

Ephemeris Hour Angle - Hour angle measured relative to the ephemeris meridian; equal to the difference between the ephemeris sidereal time and the object's right ascension.

Ephemeris Longitude - Longitude measured relative to the ephemeris meridian instead of the Greenwich meridian.

Ephemeris Meridian - The meridian line where the Greenwich meridian would be if the Earth rotated uniformly at the rate implicit in the definition of ET.

It is 1.0027379093 ΔT east of the Greenwich meridian where ΔT is the difference between ET and UT.

Ephemeris Second - The unit of ephemeris time. The tropical year at 12^hE.T. on Jan. 0, 1900 contains exactly 31556925.9747 ephemeris seconds.

Ephemeris Sidereal Time - The hour angle (referred to the ephemeris meridian) of the vernal equinox at 0^hE.T. obtained from the usual formulas for sidereal time with T measured in ephemeris time units.

Ephemeris Time - Ideally the independent variable in the equations of motion of the members of the solar system; in practice the independent variable in the equations of motion of the Moon coupled with an approximate solution of these equations.

Ephemeris Transit - The instant of ephemeris time for transit over the ephemeris meridian.

Epoch - A particular fixed instant of time used as a reference point on a time scale.

Equation of the Center - The difference between the true and mean anomalies usually expressed as a Fourier series in the mean anomaly whose coefficients depend on the eccentricity.

Equation of the Equinoxes - The right ascension of the mean equinox relative to the true equinox and equator or, equivalently (for an object on the equator), the difference between its mean and true right ascensions. The difference between the apparent and mean sidereal time.

Equation of the Equinoxes in Longitude - The same as the lunisolar nutation in longitude.

Equation of Time - The difference between apparent and mean solar times.

Equatorial Coordinate System - The spherical coordinate system of distance, declination, and right ascension (or hour angle). Topocentric, geocentric, heliocentric, and solar system barycentric systems are in use.

Equatorial Horizontal Parallax - The angle given by $\sin^{-1}(a/r)$ where a is the semi-major axis of the reference ellipsoid and r is the celestial object's geocentric distance.

Equatorial Mount or Telescope - A telescope whose mounting is such that one axis is parallel to the Earth's axis of rotation with the other axis orthogonal to it (the polar and declination axes). By driving the instrument at the sidereal rate in

a direction opposite to the Earth's angular velocity the stars will remain fixed in the field.

Equatorial Precessional Quantities - The three quantities denoted by ζ_0 , z , and θ (or J) which are used to rigorously correct equatorial coordinates for precession.

Equatorial Semidiameter - For an oblate body the value of the semidiameter along the celestial object's equator.

Equinoctial Colure - The great circle on the celestial sphere through the celestial poles and the equinoxes; its poles are the solstices.

Equinoctial Points - The equinoxes.

Equinoctial Time - Any system of time which divides the Earth's rotation period into equal (usually 24) hours.

Equinox - Usually the vernal equinox or the First Point of Aries. Very rarely does it mean the autumnal equinox.

Equinoxes - Both the points where the celestial equator intersects the ecliptic and the instants of time when the solar declination is zero.

Equivalent Width - A measure of the strength of a spectral line.

Establishment of Port - The time interval, at a particular point, between the meridian passage of the Moon and high tide.

Eulerian Nutation - The geophysical component of polar motion.

Evection - The small irregularities in the Moon's motion due to solar and planetary perturbations.

Extinction - The attenuation of light due to absorption and scattering.

Extinction Coefficient - The measure, in magnitudes per air mass, of the extinction of the atmosphere or interstellar space.

F

FC - Abbreviation for the Fundamental Catalogue of Auwers, the first in the series of German fundamental compilation catalogs. Superseded by the NFK, FK3, and FK4.

FK3 - Abbreviation for the "Dritter Fundamental Katalog des Berliner Astronomischen Jahrbuchs". Supplanted by the FK4.

FK3R - Abbreviation for the catalog which served as the basis for the revision of the FK3.

FK4 - Abbreviation for the "Fourth Fundamental Catalogue". It is the most recent in the German series of fundamental compilation catalogs and its 1535 bright stars serve as the practical approximation to an inertial reference frame.

FK4SUP - Abbreviation for "Catalogue of 1987 Supplementary Stars to FK4 for the Equinox and Epoch 1950.0".

FK5 - The successor to the FK4 expected in the mid-1980's. It will probably have ~ 5000 stars.

F Number - The ratio of the focal length of a lens or mirror to its diameter.

F Star - A bluish white star such as Canopus or Procyon showing strong lines of hydrogen and singly ionized lines of calcium, iron, and chromium.

Surface temperatures range from 6,000 to
7,500°K.

Fictitious Mean Sun - The mathematical construct used to
relate sidereal to solar times.

Field Curvature - An aberration in an optical system,
common in Schmidt telescopes, whereby the
light rays are focused on a curved surface
instead of on a plane.

Field of View - That portion of the celestial sphere,
measured in degrees, which is visible through
a telescope.

Figure of Merit - The extent to which an optical system
falls short of perfection.

Finder, Finder Telescope - A small telescope with a large
field of view used to guide larger instruments
with smaller fields of view.

First Contact - The instant of commencement of an eclipse,
occultation, or transit.

First Point of Aries - The same as the Vernal Equinox.

Flattening - The quantity denoted by f for a spheroid
of revolution; $f = (a - c)/a = 1 - (1 - e^2)^{1/2}$
where a is the semi-major axis of the generating
ellipse, c is the semi-minor axis, and e is
the eccentricity. For the Earth, $1/f = 298.257$.

Flexure - The bending of a telescope primarily due to its weight although thermal and elastic effects can be important.

Focal Length - The distance from a lens or mirror to the point where the converging light rays come to focus.

Focal Ratio - The reciprocal of the F number. Also known as the speed.

Focus - That point where the light rays converged by a lens or mirror meet to form an image.

Foreshortening Acceleration - The same as perspective acceleration.

Foreshortening Terms - The corrections to the rates of change of proper motions due to perspective acceleration (e.g., a finite distance and radial velocity). If μ and μ' are the proper motions in right ascension and declination, π is the annual parallax, and v_r is the radial velocity, then these terms contribute $-2\mu\pi v_r$ and $-2\mu'\pi v_r$ to $d\mu/dt$ and $d\mu'/dt$.

Fourth Contact - The instant of termination of an eclipse, occultation, or transit.

Full Moon - The phase of the Moon when it is at opposition and the entire visible hemisphere is illuminated.

Fundamental Catalog - A compilation catalog which uses the best available data (mainly from absolute catalogs) to approximate an inertial reference frame. Sometimes used to mean an absolute catalog.

G

GC - Abbreviation for the "General Catalogue of 33342 Stars for the Epoch 1950" by Boss.

G Star - Yellowish stars such as the Sun in which the H and K lines of ionized calcium and many other neutral and singly ionized metal lines show in their spectra. Surface temperatures range from 5,000 to 6,000°K.

Galactic Cluster - A loose, young, irregularly shaped cluster of 50 - 1000 stars located in the disc of the Galaxy.

Galactic Coordinate System - The spherical coordinate system of galactocentric distance, galactic latitude, and galactic longitude. The galactic equator is defined by neutral hydrogen radio emission.

Galactic Light - The same as diffuse galactic light.

Galactic Poles - The poles of the galactic equator. The North Galactic Pole is near $\alpha = 12^{\text{h}}49^{\text{m}}$,
 $\delta = 27^{\circ}24'$ (1950.0).

Galaxy - A large conglomeration of stars, dust, and gas external to our own Milky Way galaxy. Morphologically galaxies are classified as ellipticals, spirals, or irregulars.

Galaxy, The - Our own Milky Way galaxy which is a large spiral. The Sun lies near the Galaxy's disc about 10 kpc from the center.

Gaussian Year - The time interval associated with Kepler's third law, the solar mass, and a semi-major axis of 1 A.U.; $365^{\text{d}}06^{\text{h}}09^{\text{m}}56^{\text{s}}$.

Gegenschein - A very faint glow on the sky opposite the Sun.

General Precession - The phenomena of the secular motions of the celestial equator and ecliptic; the sum of lunisolar, planetary, and geodesic precession.

General Precession in Longitude - The secular displacement of the equinox on the ecliptic of date.

General Precession in Right Ascension - The secular motion of the equinox along the celestial equator. The sum of the equatorial precessional quantities z and ζ_0 .

Geocentric - Referred to the center of the Earth.

Geocentric Latitude - The angle between the geocentric location vector and the geodetic equator.

Geocentric Longitude - The same as geodetic longitude.

Geocentric Parallax - The same as diurnal parallax.

Geocentric Zenith - The intersection of the prolongation

of the geocentric position vector with the celestial sphere.

Geodesic Precession - A small relativistic effect which produces a motion of the equinox along the ecliptic in the opposite direction of general precession.

Geodetic Coordinates - A coordinate system (of geodetic latitude and geodetic longitude) on the Earth's surface which is dependent on the figure and size of a particular model for the Earth's surface.

Geodetic Datum - The adopted values of geodetic latitude, longitude, and azimuth at a selected location (an initial station) whose astronomical coordinates have already been determined.

Geodetic Equator - The plane swept out as the generating ellipse of the reference ellipsoid rotates about its minor axis.

Geodetic Latitude - The acute angle between the geodetic vertical and the geodetic equator.

Geodetic Longitude - The angle between the plane of the geodetic meridian and the plane of the geodetic meridian through the site of the Airy transit circle at the Old Royal Greenwich Observatory.

Geodetic Meridian - The ellipse through the point in question which passes through the geodetic poles.

Geodetic Parallels - The small circles on the reference ellipsoid parallel to the geodetic equator.

Geodetic Poles - The intersection of the axis of revolution of the reference ellipsoid with its surface.

Geodetic Refraction - The limiting case of astronomical refraction when the light path is entirely within the Earth's atmosphere.

Geodetic Vertical - The direction defined by the normal to the reference ellipsoid at the point in question.

Geodetic Zenith - The intersection of the prolongation of the outward normal to the reference ellipsoid at the point in question with the celestial sphere.

Geographic Coordinate System - A coordinate system on the surface of the Earth such as astronomical or geodetic coordinates.

Geographical Equator of Rotation - The intersection of a plane through the Earth's center, whose normal is the instantaneous axis of rotation, with the Earth's surface.

Geographic Latitude - Usually the same as the geodetic latitude.

Geographical Poles of Rotation - The two locations on the Earth's surface where the instantaneous axis of rotation of the Earth pierces it.

Geoid - The equipotential of gravity and rotation defined by the mean surface of the oceans.

Geometric Albedo - The ratio of the flux received from a planet to that expected from a perfectly reflecting Lambertian disc of the same size at the planetary distance and zero phase angle.

Gibbous Moon - A phase of the Moon when its elongation is more than 90° and more than half of the visible hemisphere is illuminated.

Globular Cluster - A tight, old, spherically shaped cluster of 10^5 - 10^6 stars. The system of globular clusters is distributed in a spherically symmetric way with respect to the galactic center.

Gnomon - A simple form of a sundial which shows local apparent solar time.

Gnomonic Projection - The projection of a spherical surface onto a plane through a point.

Gravitational Constant - See constant of gravitation.

Gravity Anomalies - Departures of the actual gravitational field of the Earth from that of the reference ellipsoid.

Gray Body - A surface whose emissivity is constant with wavelength and less than 1.

Great Circle - The locus of points on a spherical surface which is a result of the intersection of a plane through the surface's center with the surface.

Greatest Brilliancy - For a planet it's the instant when $(r + \rho + R)(r + \rho - R)/(r^3 \rho^3)$ is a maximum; r = heliocentric planetary distance, R = geocentric solar distance, ρ = geocentric planetary distance.

Greatest Elongation - For Mercury and Venus the maximum values (about 28° and 47°) of their elongations. All superior planets can achieve an elongation of 180°.

Greenwich Mean Astronomical Time - Universal Time reckoned from noon at the Greenwich meridian; usually restricted to pre-1925 dates.

Greenwich Meridian - The meridian (celestial, geodetic, etc. as appropriate) through the site of the Airy transit circle at the Old Royal Greenwich Observatory.

Greenwich Sidereal Date - The number and fraction of mean sidereal days elapsed on the Greenwich meridian since 12^h Jan. 1, 4713 BC (mean sidereal).

Greenwich Sidereal Day Number - The integral part of the Greenwich Sidereal Date.

Gregorian Calendar - The currently used civil calendar whose year has an average length of 365.^d2425 (mean solar).

H

- HD Catalog - Abbreviation for the Henry Draper Catalogue - a catalog of stellar spectra (~300,000 stars).
- Halation - The formation of a halo around bright star images by light reflected from the back of a photographic plate or emulsion.
- Halo (of the Sun or Moon) - A ring of light caused by refraction in ice crystals within cirrus clouds.
- Harvest Moon - The Full Moon nearest the time of the autumnal equinox.
- Heliacal Rising - The instant of earliest visibility of a star in the East during dusk.
- Heliacal Setting - The instant of latest visibility of a star in the West during dawn.
- Heliocentric - Referred to the center of the Sun.
- Heliocentric Parallax - The same as annual parallax.
- Heliographic Coordinates - The planetographic coordinate system for the Sun.
- Horizon Coordinate System - The spherical coordinate system of distance, altitude, and azimuth. Usually topocentric, a geocentric one is used too.
- Horizontal Parallax - The value of the diurnal parallax at the geocentric horizon.

Horizontal Refraction - The value of astronomical refraction at the horizon. It is usually taken to be 34'.

Horizontal Semidiameter - For an oblate body either the polar semidiameter divided by $(1 - e^2 \cos^2 P)^{1/2}$ or the equatorial semidiameter multiplied by $(1 - e^2 \sin^2 P)^{1/2}$ where e is the eccentricity of the oblate body and P is the position angle of the body's axis of rotation. Note that the inclination of the axis of rotation towards (away) from the observer is not included.

Hour Angle - The angular distance measured from the celestial meridian, positive towards the west, along the celestial equator to the intersection with the hour circle through the point in question; the quantity $\tau - \alpha$ where τ is the sidereal time (hour angle of the vernal equinox) and α is the right ascension.

Hour Circles - The secondary system of great circles in the equatorial coordinate systems. Each passes through the celestial poles and orthogonally intersects the celestial equator.

I

IC - Abbreviation for the Index Catalogue, the supplement to the NGC.

I Magnitude - The infrared magnitude of the extended UBV (e.g., UBVRI) system centered at 0.9μ .

Image - The optical representation of an object produced by the refractions or reflections of an optical system of the light rays reflected or emitted by the object.

Image Tube - A device in which electrons, emitted from a photo-sensitive surface, are electromagnetically focused to form an image.

Immersion - The disappearance of the occulted body at the limb of the occulting body; the disappearance of an eclipsed body at the edge of the shadow of the eclipsing body; the beginning of an occultation or eclipse.

Inclination - The angle between the orbital plane of a body and some reference plane.

Independent Catalog - A catalog of positions obtained without reference to other such positions.

Independent Day Numbers - The quantities denoted by $f, g, G, h, H,$ and i used in the reduction of a catalog mean place to apparent place.

Index of Refraction - The ratio of the speed of light in vacuo to its speed in the medium at hand.

Inequality - A periodic term added to the principal terms in the right ascension or ecliptic longitude of a celestial object; the equation of time is an example of an inequality for the Sun.

Inertial System - A coordinate system in which Newton's Laws of motion are rigorously valid without the addition of fictitious forces.

Inferior Conjunction - A conjunction of an inferior planet.

Inferior Planet - Mercury or Venus; a planet whose orbit lies inside the Earth's.

Ingress - The motion of a planet across the limb of the Sun at the beginning of a transit.

Initial Station - A location for which the geodetic datum is available.

Insolation - The rate at which all radiation is received from the Sun per unit area at a heliocentric distance of 1 A.U.

Intercalary Day - A day added to a calendrical system to bring the average length of the calendar year closer to the length of a tropical year.

International Atomic Time - The international form of atomic time post-1972; I.A.T. = E.T. - 32^s.18.

International Magnitude System - The system of photographic (m_{pg}) and photovisual (m_{pv}) magnitudes. Usually B and V of the UBV system is used now.

Interplanetary Medium - The tenuous collection of gas, dust, and particles in interplanetary space.

Interstellar Absorption - The diminution and reddening of light in interstellar space due to the interstellar medium.

Interstellar Extinction - The same as interstellar absorption.

Interstellar Medium - The gas, dust, and particles of interstellar space.

Invariable Plane - The plane whose normal is given by the direction of the total angular momentum vector of the solar system. It is inclined by about 2° with respect to the ecliptic due to Jupiter.

Irradiation - An optical effect of contrast which leads to the erroneous determinations of the sizes of celestial objects with appreciable discs.

J

Julian Calendar - The calendrical system introduced by
Julius Caesar in 45 BC.

Julian Century - A count of exactly 36525 days.

Julian Date - The number and fraction of days, in mean
solar measure, elapsed since 12^h Jan. 1, 4713 BC
(U.T.).

Julian Day Number - The integral part of the Julian Date.

Julian Ephemeris Date - The number and fraction of days,
in ephemeris time measure, elapsed since
12^h Jan. 1, 4713 BC (E.T.).

Julian Year - One hundredth of a Julian Century.

K

KSS - The abbreviation for a catalog of 3356 faint
($m_{pg} = 8 - 10^m.5$) stars north of $\delta = -5^\circ$
on the FK3 system.

Kepler's Equation - The relationship between the
eccentric anomaly (E) and the mean anomaly
(M) $E - e \sin E = M$ (where e is the
eccentricity) in the two-body problem.

Kepler's Laws - Three rules governing planetary motion
under the gravitational force. They are (i)
each planet revolves about the Sun in an
elliptical orbit with the Sun at one focus,
(ii) the heliocentric location vector sweeps
out equal areas in equal times, and (iii) the
square of the period of revolution is proportional
to the cube of the semi-major axis.

Kirkwood Gaps - Regions in the asteroid belt, at mean
motions commensurate with Jupiter's, devoid of
asteroids.

L

Lagrangian Points - Five equilibrium solutions of the restricted three-body problem. Three are unstable and two (which complete an equilateral triangle) are stable. The Trojan asteroids are at the stable Lagrangian points of the Jupiter-Sun system.

Lambert's Law - The statement that the intensity of light reflected from a perfectly diffuse surface is proportional to the cosine of the angle between the outward surface normal and the direction of observation.

Late Type Star - The cooler stars of spectral type F6 - F9, G, K, and M.

Latitude - The acute angle between a direction and the fundamental reference plane.

Leap Year - A year in a calendrical system containing one or more intercalary days.

Level Surface - Equipotential surfaces near the Earth which includes all forces (i.e., Earth gravitation, rotation, lunisolar perturbations, and planetary perturbations).

Libration - Any of several phenomena which enable an Earth-bound observer to see ~59% of the lunar

surface. A division is made between optical, apparent, and physical or dynamical librations.

Libration in Latitude - The component of libration due to the fact that the Moon's axis of rotation is not perpendicular to its orbital plane.

Libration in Longitude - The component of libration due to the fact that the lunar rotational speed is constant but its orbital speed is not.

Light Curve - A graphical or tabular representation of the brightness variation of a celestial object as a function of time.

Light Year - The distance traversed by light in one year. Approximately 0.307 pc.

Limb - The apparent edge of the disc of a celestial object projected onto the plane of the sky.

Limb Darkening - The decrease in brightness of the Sun or other star when moving from the center of the disc towards the limb.

Limiting Magnitude - The faintest magnitude that can be seen, measured, etc. by an instrument, technique, search, etc.

Line of Apsides - The line connecting the apses of an orbit; the semi-major axis for an ellipse, the line of symmetry for a parabola or hyperbola.

Line of Nodes - The line connecting the nodes of an orbit.

Line of Position - The line connecting the points of a two or three-star fix of a navigator.

Line Profile - A plot or graph of the intensity of light versus wavelength across a spectral line or feature.

Linear Acceleration - The second time derivative of the location; the time rate of change of the linear velocity.

Linear Momentum - The product of a body's mass and its linear velocity.

Local Astronomical Meridian Line - The same as the local north-south line.

Local Mean Noon - That instant of time when the fictitious mean Sun culminates.

Local Mean Time - Universal Time minus the observer's west longitude.

Local North-South Line - The intersection of the plane of the celestial meridian with the Earth's surface.

Local Reference System - The two immediately realizable coordinate systems of astronomy - the horizon (celestial) and astronomical (geographic).

Local Sidereal Time - The hour angle of the vernal equinox; the Greenwich sidereal time minus the west longitude.

Location (position in physics) - The complete three-dimensional specification of one's situation with respect to a coordinate system.

Lommel-Seeliger Surface - A rough surface for which shadowing effects are important when analyzing its reflective properties.

Longitude - The angular distance, measured in the fundamental reference plane, from a fixed origin.

Longitude of the Ascending Node - The longitude of the intersection of the orbital plane with the reference plane where the latitudinal coordinate is increasing.

Longitude of the Descending Node - The longitude of the intersection of the orbital plane with the reference plane where the latitudinal coordinate is decreasing.

Longitude of Periastron - The sum of the longitude of the ascending node and the argument of periastron. Similarly for the longitude of perigee or perihelion.

Lower Culmination - That instant when (algebraically)
the altitude of a celestial object is least.

Lower Transit - That instant when the hour angle of a
celestial object is $+12^h$.

Luminosity - The total radiant energy output per unit
time.

Luminosity Class - A luminosity and surface gravity
classification of stars using (primarily)
Roman numerals I - V. Normal stars (dwarfs)
are in Class V, subgiants are in classes
III and IV, giants are in class II, and
supergiants are in class I.

Lunar Eclipse - An eclipse of the Moon by the Earth.

Lunation - The sequence of phases of the Moon. The
time interval associated with a complete
cycle of phases.

Lunisolar Nutation in Longitude - The variable periodic
motion of the true celestial pole about the
mean pole.

Lunisolar Nutation in Obliquity - The periodic oscillation
in the inclination of the true celestial
equator with respect to the fixed ecliptic.

Lunisolar Precession - The regular westward motion of the
equinox relative to a fixed ecliptic due to the

torques exerted on the Earth's equatorial bulge
by the Sun ($\sim 1/3$) and Moon ($\sim 2/3$).

Lunisolar Precession in Longitude - The product of the
precessional constant and the cosine of the
mean obliquity of the ecliptic.

Lunisolar Precession in Right Ascension - The sum of the
general precession in right ascension ($z + \zeta_0$)
and the planetary precession.

M

MKK System - A system of classifying stars by using the type, intensities, and widths of spectral lines.

It combines spectral type and luminosity class.

M Star - Red stars such as Antares and Betelgeuse whose spectra are dominated by neutral metal and titanium oxide lines. Surface temperatures are less than 3,000°K.

Magnitude - A number, with an arbitrary zero point, measured on a logarithmic scale used to indicate the brightness of an object;
magnitude = $-2.5 \log (\text{luminosity}) + \text{constant}$.

Magnitude of an Eclipse - The fraction of the diameter of the body being eclipsed which is shadowed.

Magnitude Term - The effect of apparent brightness on the measurement of a celestial object's position.

Major Planet - One of the nine larger bodies in the solar system - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, or Pluto.

Maksutov Telescope - A reflecting telescope with a spheroidal (instead of parabolic) primary mirror.

Mean Anomaly - The quantity $n(t - T)$ where n is the mean motion, t is the time, and T is the instant of periastron passage.

Mean Catalog Place or Position - The mean place plus the effects of elliptic aberration.

Mean Equator - The great circle on the celestial sphere which represents the instantaneous celestial equator exclusive of periodic perturbations.

Mean Equatorial Horizontal Parallax - The value of the equatorial horizontal parallax when the average geocentric distance replaces the instantaneous geocentric distance.

Mean Equator and Equinox - Phrase used to denote that the reference system has been corrected for general precession (secular effects) but not nutation (periodic effects).

Mean Equinox - The ascending node of the ecliptic on the mean equator.

Mean Longitude - The sum of the longitude of the ascending node, the argument of periastron, and the mean anomaly.

Mean Motion - The quantity $2\pi/P$ where P is the period of revolution.

Mean Obliquity - The inclination of the ecliptic to the mean equator.

Mean Place or Position - That point on the celestial sphere at which a celestial object would be seen from the solar system barycenter relative to the mean equator and equinox at the beginning of a Besselian solar year.

Mean Pole - The North Celestial Pole of the mean equator.

Mean Refraction - The value of the astronomical refraction at some standard atmospheric state (e.g., fixed pressure, temperature, humidity, etc.).

Mean Semidiameter - The value of the semidiameter at the average geocentric distance.

Mean Sidereal Day - The average time interval between two successive upper transits of the mean equinox.

Mean Sidereal Time - The hour angle of the mean equinox.

Mean Solar Day - The time interval between two successive upper transits of the fictitious mean Sun; the average (over a year) of the length of an apparent solar day.

Mean Solar Time - The hour angle of the fictitious mean Sun plus 12^h.

Mechanical Ellipticity - The same as dynamical flattening.

Meridian - The same as celestial meridian.

Meridian Circle - An optical instrument constrained to move in the plane of the celestial meridian and equipped with a graduated vertical circle for the determination of zenith distances at transit.

Meridian Line - The intersection of the plane of the celestial meridian with the plane of the astronomical horizon.

Messier Catalog - Catalog of 104 non-stellar objects compiled principally by C. Messier in the eighteenth century.

Meteor - The excitation of the Earth's atmosphere observed visually or by radar which accompanies the passage of a meteoroid through the atmosphere.

Meteor Shower - The occurrence of a large number of meteors all of which appear to originate from the same point on the celestial sphere (called the radiant).

Meteor Train - The trail of excitation left by a meteor.

Meteorite - The remnant of a meteoroid which reaches the ground.

Meteoroid - A small particle in interplanetary space.

Method of Dependences - An outmoded graphical technique developed by Schlesinger for the rapid approximate solution of the linear plate model.

Metonic Cycle - The interval of time associated with 235 lunations or 19 years (1 yr = 365^d.25).

Micrometer - An instrument used to measure positions within the field of view of a telescope.

Milky Way - The name for the Galaxy; the luminous band of light seen along the galactic equator.

Minor Planet - The same as an asteroid.

Modified Julian Date - The Julian Date minus 2,400,000.5.

Monochromatic - Of a single wavelength (i.e., zero bandwidth).

Month - The calendrical measure roughly associated with a lunation.

Moon, The - The single natural satellite of the Earth.

Moon - A natural satellite of a major planet.

N

N30 - The abbreviation for the "Catalog of 5268 Standard Stars, 1950.0, based on the Normal System N30" by Morgan.

NFK - Abbreviation for the "Neuer Fundamental-Katalog" of Peters. It supplanted the FC and was supplanted by the FK3.

NGC - Abbreviation for "A New General Catalogue of Nebulae and Clusters of Stars" by Dreyer.

Nadir - The point on the celestial sphere diametrically opposite the zenith.

Nautical Twilight - The interval of time between sunrise or sunset and the instant when the Sun's depression is 12° (zenith distance = 102°).

Neap Tide - The lowest tides in a month which occur when the Moon is near first or third quarter.

Nebula, Nebulosity - The term used to describe a fuzzy, diffuse patch of light on the celestial sphere.

New Moon - That phase of the Moon when it is in inferior conjunction and the visible hemisphere is unilluminated.

Newton's Law of Gravity - The statement that every particle in the universe attracts every other

particle with a force proportional to its mass, inversely proportional to the square of their separation, and along the line joining them.

Newton's Laws of Motion - The three statements that (i) every body continues in its state of rest or uniform rectilinear motion unless an external force acts to change it, (ii) when such an external force does act the product of the object's mass and resulting acceleration is equal to the impressed force, and (iii) when two objects exert forces on each other these forces are equal in magnitude and opposite in direction.

Newtonian Focus - A reflecting telescope with a flat mirror that brings the focal point at the side of the telescope tube.

Night Sky Background - The faint, diffuse illumination of the night sky due to airglow, diffuse galactic light, and the zodiacal light.

Node(s) - The point(s) of intersection of the orbital plane of a body with the fundamental reference plane.

Nodical Month - The same as a Draconic month.

Nodical Year - The same as an eclipse year.

Nonagesimal Point - The point on the ecliptic with the largest altitude.

North Celestial Pole - That celestial pole when which above the direction of rotation of the Earth (celestial sphere) appears counterclockwise (clockwise).

North Point - That intersection of the celestial meridian with the astronomical horizon 90° counterclockwise from the East Point.

North Polar Distance - The complement of the declination; less frequently the complement of the ecliptic latitude.

North Polar Sequence - A group of stars within 2° of the North Celestial Pole which serve as standards for the International Magnitude System.

North Terrestrial Pole - That terrestrial pole from above which the Earth's direction of rotation would appear to be counterclockwise.

Nova - A star that exhibits a sudden outburst of radiant energy which may increase its apparent magnitude by as much as 14^m .

Nucleus of a Comet - A swarm of solid particles at the core of a comet.

Nutation - That variable periodic motion of the mean equator due principally to the Moon.

Nutation in Longitude - The difference between the true
and mean ecliptic longitude.

Nutation in Obliquity - The difference between the true
and mean obliquity of the ecliptic.

Nutation in Right Ascension - The obsolete name for the
equation of the equinoxes.

O

- O Star - Very blue stars such as 10 Lac with few absorption lines, those of ionized helium and doubly ionized nitrogen dominating. Surface temperatures are in excess of 25,000°K.
- Objective - The principal image forming component of an optical system.
- Oblate Spheroid - The figure generated by rotating an ellipse about its minor axis.
- Obliquity of the Ecliptic - The inclination of the ecliptic to the celestial equator; about 23°27'.
- Occular - Eyepiece.
- Occultation - The disappearance of one celestial body behind the disc of another.
- Open Cluster - The same as a galactic cluster.
- Opposition - That situation when two celestial objects are diametrically opposite each other on the celestial sphere; most frequently used when one of the objects is the Sun.
- Optical Double - Two stars seen in the same direction but not physically associated.
- Optical Libration - That component of libration due to variations in the geometric position of the Earth relative to the Moon.

Orbital Elements - The quantities which completely describe the size, shape, and orientation of an object's orbit as well as its location in it. The classical set consists of the semi-major axis, the eccentricity, the argument of periastron, the inclination, the longitude of the ascending node, and the time of periastron passage.

Osculating Ellipse - That ellipse instantaneously tangent to the actual orbit.

Orthometric Correction - A correction in the determination of elevations due to the fact that the level surfaces are not parallel.

P

Parallactic Angle - The angle at the point in question between the hour circle and the vertical circle.

Parallactic Ellipse - The locus of points on the celestial sphere occupied by a star during the annual revolution of the Earth about the Sun due to parallax.

Parallactic Refraction - The correction to astronomical refraction which incorporates the finite diurnal parallax of the celestial body.

Parallax - The displacement of the position of a celestial object due to a translation of the coordinate system.

Parallax Constants - The two quantities $\pi_{\odot}\rho\cos\phi'$ and $\pi_{\odot}\rho\sin\phi'$ where ρ is the observer's geocentric distance, ϕ' is his geocentric latitude, and π_{\odot} is the solar parallax constant.

Parallax Factors - The two quantities $\rho\pi_{\odot}\cos\phi'\sinh\sec\delta$ (in right ascension) and $\rho\pi_{\odot}\sin\phi'\cos\delta$ - $\rho\pi_{\odot}\cos\phi'\cosh\sin\delta$ (in declination) where ρ , π_{\odot} , ϕ' were defined above and h , δ are the hour angle and declination of a celestial object.

Parallax of Light - The same as the correction for light time.

Parallels of Altitude - The same as almucantars.

Parallels of Declination - The small circles parallel to the celestial equator.

Parallels of Latitude - The small circles parallel to the ecliptic; the small circles parallel to the astronomical horizon.

Parametric Latitude - The same as eccentric latitude.

Parsec - The distance such that the parallax of 1 A.U. is 1"; (1 A.U.) $\text{cscl}'' \approx 3.086 \times 10^{16} \text{m}$.

Partial Eclipse - An eclipse which is not total or annular, that is there is only partial entry into the eclipsing body's shadow cone.

Penumbra - The region behind an illuminated body which is neither in total darkness (the umbra) nor completely illuminated.

Penumbral Eclipse - An eclipse wherein the eclipsed body only enters the eclipsing body's penumbra.

Periastron - That point in the orbit of a celestial object when it is closest to the primary.

Perigee - That point in a geocentric orbit when the geocentric distance is a minimum.

Perihelion - That point in a heliocentric orbit when the heliocentric distance is a minimum.

Period - The time interval necessary for the completion of a single cycle of a repetitive process.

Periodic Comet - A comet which returns to visibility after a lapse of several years.

Personal Equation - The systematic biases peculiar to an individual observer.

Perspective Acceleration - The component in the variation of the proper motion due to the combination of radial velocity and annual parallax.

Perturbation - The action of additional, usually small, forces on the motion of an object.

Phase - The phenomena of the varying appearances of the illuminated portions of the discs of solar system objects.

Phase Angle - The angle an illuminated object between the source of illumination and the observer.

Phase Function - The ratio of the brightness of an illuminated body at some phase angle to its brightness at zero phase angle.

Phase Function in Magnitudes - The quantity $-2.5 \log$ (phase function).

Phase Integral - The quantity $\int_0^{2\pi} \phi(\alpha) \sin \alpha d\alpha$ where α is the phase angle and ϕ is the phase function.

Photographic Magnitude - The magnitude of a celestial object as measured on traditional blue sensitive emulsions.

Photoelectric Photometry - Photometry performed with a photomultiplier tube or pulse counting photometer.

Photographic Photometry - Photometry performed with a photographic plate and an image diameter - magnitude relationship.

Photometry - The measurement of light intensities.

Photovisual Magnitude - The magnitude of a celestial object as determined photographically but in the wavelength band of maximum visual sensitivity.

Physical Libration - The same as dynamical libration.

Plane of the Ecliptic - The plane determined by the ecliptic.

Plane of the Sky - The plane normal to the direction of the line of sight projected onto the celestial sphere.

Planet - A solid body in the solar system.

Planetary Aberration - The sum of stellar aberration and the correction for light-time.

Planetary Precession - The small regular westward motion

of the equinox on the ecliptic due to gravitational perturbations exerted on the Earth. These perturbations also cause a decrease in the obliquity of the ecliptic.

Planetocentric Coordinates - The analog of geocentric coordinates for the Sun, Moon, and planets.

Planetographic Coordinates - The analog of geographic coordinates for the Sun, Moon, and planets.

Plate Constants - The parameters of a plate model.

Plate Model - The relationship between ideal and measured standard coordinates.

Plate Scale - The ratio of a linear distance on a photographic plate to the corresponding angular distance on the celestial sphere.

Polar Axis - The axis of rotation of the Earth; the axis of an equatorial mount which points towards the elevated celestial pole.

Polar Distance - Generally the distance from the elevated celestial or ecliptic pole; usually the complement of the declination.

Polar Motion or Wandering - The motion of the instantaneous axis of rotation of the Earth with respect to the solid body of the Earth.

Polar Semidiameter - For an oblate body the value of the semidiameter through the poles of rotation.

Pole Star - Polaris.

Position - The direction in which an object is seen.

Position Angle - The spherical angle whose vertex is at the reference object between the circle of declination through this object and the great circle through both the reference object and the celestial body of interest. Measured from the north toward the east.

Positional Astronomy - That part of astronomy that deals with the deduction of the positions of celestial objects (principally the brighter stars, the planets, the larger asteroids, the Moon, and the Sun) for the purpose of determining an inertial reference frame.

Practical Astronomy - The theory of the construction of, the errors of, and the use of the observing instruments of astronomy.

Precession in Declination - The equatorial precessional quantity θ .

Precession of the Equinoxes - The slow westward progression of the equinoxes on the ecliptic.

Prime Meridian - The terrestrial meridian associated with

the Airy transit circle at the site of the Old Royal Greenwich Observatory; the origin of geographic longitudes.

Prime Vertical - The vertical circle perpendicular to the celestial meridian.

Prograde Motion - Same as direct motion.

Prolate Spheroid - The figure generated by rotating an ellipse about its major axis.

Proper Motion - The angular rate of movement of a celestial object due to its intrinsic motion relative to an inertial frame.

Proper Motion in Declination - The declination component of the proper motion.

Proper Motion in Right Ascension - The right ascension component of the proper motion.

Proper Motion in Right Ascension along a Great Circle - The product of the proper motion in right ascension and the cosine of the declination.

Q

Quadrature - That configuration of two solar system objects when their geocentric longitudes differ by $\pm 90^\circ$; an object whose elongation is 90° or 270° (-90°).

R

R Magnitude - The red magnitude of the extended UBV
(e.g., UBVRI) system centered at 0.7μ .

Radial Velocity - The signed component of velocity along
the line of sight.

Radian - The central angle subtended by an arc of a circle
equal in length to the radius of the circle.

Radiant of a Meteor Shower - That point on the celestial sphere
from which the meteor trails appear to originate.

Rational Horizon - The astronomical horizon with its
center displaced to the Earth's center.

Red Shift - The shift of spectral lines to longer
wavelengths due to the Doppler effect or
gravitational effects.

Reduced Latitude - The same as eccentric latitude.

Reduction to the Ecliptic - The difference between the
ecliptic and orbital longitudes of a planet.

Reflecting Telescope - An optical instrument which uses
a concave mirror as the objective.

Refracting Telescope - An optical instrument in which
the objective is a lens or system of lenses.

Relative Catalog - A catalog of positions obtained by
measuring the positions of the stars relative
to stars of known position.

Resolution - The degree to which fine details in an image can be resolved.

Resolving Power - A measure of an optical system's resolution.

Reticle - A system of cross hairs in the eye piece of a telescope.

Retrograde Motion - The opposite of direct motion.

Right Ascension - The angular distance measured from the vernal equinox, positive to the east, along the celestial equator to the intersection of the celestial equator with the hour circle through the point in question.

Rising - That instant of time when the geometric zenith distance is 90° and the object is in the east.

Ritchey-Chretien Telescope - A system of two aspherized mirrors which give an image at the secondary (Cassegrain) focus free of spherical aberration and coma.

S

SAOC - Abbreviation for the ~250,000 star catalog
produced by the SAO.

SRS - Abbreviation for the "Southern Reference Star Program"
which will produce an AGK3R type catalog for the
southern hemisphere.

Saros Cycle - The interval of time equal to 223 lunations
= 19 anomalistic years = 242 draconic months
= 239 anomalistic months = $18^y 11^d 8^h$; a period
of time useful for the prediction of repetitive
eclipses.

Schmidt Telescope - A special very wide field camera
with very small distortions. An aspherical
correcting plate is used to eliminate the
(spherical) primary's spherical aberration.

Scintillation - Variations in the brightness of a
celestial object caused by turbulent motions
in the upper atmosphere.

Sea Time - An obsolete civil calendar used by navigators.

Seasonal Hours - A time system that divides the total
daytime and nighttime portions of a day
separately into 12 equal hours.

Second Contact - The instant of the commencement of
totality in an eclipse, occultation, or transit.

- Second Flattening - The quantity af/c where f is the flattening, a the semi-major axis, and c the semi-minor axis of an ellipse.
- Second-Order Day Number - The quantities denoted by J and J' used in the reduction of a star's mean catalog place to its apparent place.
- Secondary Circles - The system of great circles through the poles of the fundamental reference circle.
- Secular Aberration - That component of the aberration of light due to the motion of the solar system through interstellar space.
- Secular Acceleration - The same as perspective acceleration.
- Secular Parallax - The angle given by $\sin^{-1}(d/r)$ where d is the distance traversed by the solar system in a year and r is the heliocentric distance of the star.
- Secular Variations - The time rate of change of the annual variations.
- Seeing - A descriptive term used to indicate the quality of a telescopic image perturbed by turbulent motions in the lower atmosphere.
- Selected Areas - 262 small regions on the celestial sphere whose stellar content is used as a sample in various surveys.

Selenographic Coordinates - The planetographic coordinate system of the Moon.

Semidiameter - The angular measure of the disc of a celestial object. If R is the object's linear radius and r is the object's geocentric distance, then the semidiameter is given by $\sin^{-1}(R/r)$.

Semidiurnal Arc - The hour angle at rising or setting.

Sensible Horizon - The same as the astronomical horizon.

Setting - That instant of time when the geometric zenith distance is 90° and the object is in the west.

Sextant - An instrument for the determination of geographical position (usually by measuring altitudes) from a moving platform.

Shadow Cone - The dark region (umbra) of conical shape formed by the object intercepting the illumination.

Short Period Nutation - Those parts of nutation which depend on the Moon's longitude.

Sidereal Day - The time interval between two successive upper transits of the vernal equinox.

Sidereal Hour Angle - The exponent of the right ascension; $360^\circ - \alpha$ or $24^h - \alpha$. Formerly called the versed ascension.

Sidereal Month - The time interval for a complete revolution of the Moon about the Earth with respect to the stars; $27^{\text{d}}07^{\text{h}}43^{\text{m}}12^{\text{s}}$.

Sidereal Noon - The instant of upper transit of the vernal equinox.

Sidereal Period - The period of revolution or rotation with respect to the stars.

Sidereal Time - The measure of time defined by the motion of the vernal equinox in hour angle; the hour angle of the vernal equinox.

Sidereal Year - The period of revolution of the Earth about the Sun with respect to the stars; $365^{\text{d}}06^{\text{h}}09^{\text{m}}10^{\text{s}}$.

Signs of the Zodiac - The twelve constellations along the ecliptic.

Small Circle - Any circle on a spherical surface that is not a great circle.

Solar Apex - The point on the celestial sphere towards which the solar system motion is directed ($\alpha \sim 18^{\text{h}}$, $\delta \sim 30^{\circ}$ at ~ 20 km/sec).

Solar Constant - The amount of energy deposited per unit area per unit time at a heliocentric distance of 1 A.U.

Solar Day - The time interval between two successive upper transits of the Sun.

Solar Eclipse - An eclipse of the Sun by the Moon.

Solar Parallax - See constant of solar parallax.

Solar Motion - The motion of the solar system through interstellar space; see solar apex.

Solar System, The - The system of the Sun, major planets, minor planets, moons, comets, and interplanetary debris.

Solar Time - The hour angle of the Sun plus 12^{h} .

Solar Wind - A radial outflow of particles from the Sun.

Solstices - Both the points on the ecliptic 90° away from the equinoxes and the instants of time when the solar declination is an extremum.

Solstitial Colure - That great circle through the celestial poles and the solstices; its poles are the equinoxes.

South Point - That intersection of the celestial meridian with the astronomical horizon 90° clockwise from the East Point.

Spectral Class or Type - A temperature classification of stars using (primarily) the letters O, B, A, F, G, K, M in order of decreasing surface temperature. Decimal subdivisions (O9, B0, B1, ..., B9, A0 etc.) are used for greater precision.

Spectrograph - An instrument for photographing a spectrum.

Spectroheliograph - An instrument for photographing the Sun, or part of the Sun, in monochromatic light.

Spectrophotometry - The measurement of light intensities at different wavelengths.

Spectroscope - An instrument for directly viewing the spectrum of a light source.

Spectroscopic Parallax - An estimate of a star's annual parallax based on its spectral class, apparent magnitude, and spectral class-luminosity relationship.

Speed of General Precession in Declination - The quantity denoted by n which gives the amplitude of $d\delta/dt$ due to general precession.

Speed of General Precession in Right Ascension - The quantity denoted by m which gives the amplitude of $d\alpha/dt$ at $\delta = 0$ due to general precession.

Speed of Light - The quantity denoted by $c = 299,792,458$ m/sec.

Spherical Aberration - An aberration of an optical system whereby off-axis rays of light striking different parts of the objective do not come to focus in the same place.

Spherical Angle - The angle whose vertex is at the intersection of two great circles.

Spherical Astronomy - The principles of observation and reduction of the positions of the principal celestial objects.

Spherical Triangle - The figure formed on a spherical surface by three great circles which do not share a point in common.

Spiral Galaxy - A galaxy whose principal optical features are arms spiralling out of a spheroidal nuclear region. The arms lie in a plane which defines the disc of the galaxy. Spiral galaxies usually have abundant gas, dust, and young stars and are in differential rotation.

Sporadic Meteor - A meteor not associated with a meteor shower.

Standard Coordinates - A system of rectangular coordinates in the focal plane of a telescope related to celestial coordinates by the gnomonic projection.

Star Catalog - A list of accurate star positions.

Star Constants - See Besselian star constants.

Station Error - Geodetic minus astronomical latitude.

Stationary Point - That point in a planet's heliocentric orbit when the first time derivative of its geocentric right ascension is equal to zero.

Statistical Parallax - An estimate of a star's annual parallax made from statistical considerations

of similar stars, their parallaxes and proper motions.

Stellar Aberration - That component of the aberration of light due to a combination of the observer's and the light source's motion and distance apart.

Steradian - The solid angle at the center of a spherical surface subtended by an area of the surface equal to the square of the surface's radius.

Substellar Point - That point on the surface of the Earth where the geocentric position vector of the star pierces it.

Summer Solstice - Both the point on the ecliptic of maximum solar declination and the instant at which it occurs.

Sumner Line - The same as the line of position.

Sun, The - The star of the solar system.

Sundial - An instrument which shows local apparent solar time.

Superior Conjunction - A conjunction of a superior planet.

Superior Planet - Mars, Jupiter, Saturn, Uranus, Neptune or Pluto; a planet whose orbit lies outside the Earth's.

Supernova - A stellar explosion which results in an

enormous ($10^5 - 10^8$) temporary increase in
luminosity.

Synodic Month - The time interval between two successive
New Moons; $29^d 12^h 44^m 03^s$.

Synodic Period - The period of revolution of a planet
(or Moon) with respect to the Earth; it is
the time interval between corresponding aspects.

Syzygy - The instant of Full or New Moon.

T

T.A.I. - The abbreviation for International Atomic Time.

Tail of a Comet - The visible swarm of gas and particles vaporized from the head of a comet by sunlight.

Tangential Velocity - The quantity $4.74\mu/\pi$ km/sec where μ is a star's proper motion in "/yr and π is the annual parallax in seconds of arc.

Telescope - An optical instrument used to aid in the viewing, measuring, or photographing of distant objects.

Terminator - The line of demarcation of the illuminated and unilluminated portions of a planet.

Theodolite - A mobile telescope used to measure altitude and azimuth.

Terrestrial Planet - One of the inner planets; Mercury, Venus, Earth, or Mars.

Terrestrial Refraction - The same as geodetic refraction.

Theoretical Astronomy - The undertaking, based upon the laws of physics, of describing and predicting the locations and motions of celestial objects.

Third Contact - The instant of the beginning of termination of totality in an eclipse, occultation, or transit.

Tide - The deformation of a body due to the action of external differential gravitational forces.

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Time of Periastron Passage - The instant of time corresponding to the point of closest approach in an orbit. Similarly for the times of perigee or perihelion passage.

Time Zones - Belts of longitude $\sim 15^\circ$ wide on the surface of the Earth used for fixing civil time.

Topocentric - Referred to the observer.

Topocentric Librations - That component of libration due to the varying position of the observer on the surface of the Earth.

Topocentric Place or Position - The actual direction on the celestial sphere towards which a perfect optical instrument would be directed to see a celestial object. It includes corrections for diurnal parallax, refraction, and diurnal aberration to the apparent place. The reference frame is the true equinox and ecliptic of date.

Total Eclipse - An eclipse wherein the shadow cone of one celestial object completely covers another or an eclipse wherein the disc of one celestial object completely obscures another.

Total Proper Motion - The quantity $[(\mu \cos \delta)^2 + (\mu')^2]^{1/2}$ where μ and μ' are the proper motions in right

ascension and declination and δ is the declination.

Torque - The vector cross-product of the location and the force; it's the time rate of change of the angular momentum.

Transit - An eclipse of the Sun by an inferior planet. The instant of crossing the celestial meridian.

Transit Circle - An optical instrument used to measure the declination of a celestial object during its transit.

Trigonometrical Parallax - The annual parallax of a star. The name refers to the deduction of this value (by the application of standard surveying techniques).

Tropic of Cancer - The parallel of terrestrial latitude whose latitude is approximately equal to the obliquity of the ecliptic.

Tropic of Capricorn - The parallel of terrestrial latitude whose latitude is approximately equal to the negative of the obliquity of the ecliptic.

Tropical Month - The period of revolution of the Moon with respect to the equinox; $27^{\text{d}}07^{\text{h}}43^{\text{m}}05^{\text{s}}$.

Tropical Year - The period of revolution of the Sun with respect to the equinox; $365^{\text{d}}05^{\text{h}}48^{\text{m}}46^{\text{s}}$.

True Anomaly - The angular distance, measured in the orbital plane from the occupied focus, from the periastron point to the current location of the orbiting body.

True Bearing - The azimuth plus 180° , used in navigation.

True Equator - The great circle on the celestial sphere which represents the instantaneous celestial equator including periodic perturbations.

True Equinox - The ascending node of the ecliptic on the true equator.

True Longitude - The sum of the longitude of the ascending node, the argument of periastron, and the true anomaly.

True Place or Position - That place on the celestial sphere where a celestial object would be seen from the solar system barycentric reference system of true equator and equinox of date. It includes corrections to the mean place for proper motion, precession, the e-terms of aberration, and nutation.

True Pole - The North Celestial Pole of the true equator.

Twilight - The interval of time after sunset and before sunrise when the upper atmosphere is illuminated, hence it is not yet completely dark.

U

U Magnitude - The ultraviolet magnitude of the UBV system centered at 3650\AA .

UBV System - The three color, wide-band photometric system developed by H. L. Johnson and W. W. Morgan.

ubvy System - The four color, intermediate-band photometric system developed by B. Stromgren.

U.T. - The abbreviation for Universal Time.

UT0 - Universal Time as deduced directly from observations of stars and the fixed numerical relationship between Universal and sidereal times.

UT1 - UT0 corrected for polar motion.

UT2 - UT1 corrected for seasonal variations in the Earth's rotation rate.

UTC - Universal Time Coordinated; a uniform atomic time system kept very close to UT2 by offsets.

Umbra - The completely dark portion behind an illuminated body.

Umbral Eclipse - An eclipse in which the body being eclipsed passes entirely through the eclipsing body's umbra.

Universal Time - Mean solar time on the Greenwich meridian.

Upper Culmination - That instant when (algebraically) the altitude of a celestial object is greatest.

Upper Transit - That instant when the hour angle of a celestial object is 0^{h} .

V

V Magnitude - The visual or yellow magnitude of the UBV system centered at 5500\AA .

Variable Star - A star whose apparent brightness varies with time.

Variation of Latitude - A slight semi-periodic change in one's latitude due to a shift of the solid body of the Earth with respect to its rotation axis.

Velocity - The time rate of change of location.

Vernal Equinox - The intersection of the celestial equator with the ecliptic where the Sun's geocentric declination is increasing.

Vertical Circles - The system of secondary circles in the horizon system.

Vertical Semidiameter - For an oblate body the polar semidiameter divided by $(1 - e^2 \sin^2 P)^{1/2}$ where e is the eccentricity of the oblate body and P is the position angle of the body's axis of rotation.

Vignetting - A systematic error in measuring magnitudes when the object of interest is off-axis.

Visible Horizon - The same as apparent horizon.

Visual Magnitude - The same as the V magnitude.

W

Waning Gibbous - The gibbous phase of the Moon when the visible illuminated portion is decreasing in area.

Waxing Gibbous - The gibbous phase of the Moon when the visible illuminated portion is increasing in area.

West Point - That point on the astronomical horizon 90° (measured counterclockwise) from the North Point. The Sun appears to set at the West Point at the equinoxes.

Winter Solstice - Both the point on the ecliptic of minimum solar declination and the instant at which it occurs.

World Calendar - A suggested reform of the civil calendar which would divide the year into four identical quarters and the same date of the month would always fall on the same day of the week.

X

Y

Yale Catalogues - A large, inhomogeneous group of photographic zone catalogs covering the entire celestial sphere.

Year - The interval of time associated with a revolution of the Earth about the Sun.

Z

Zenith - The point on the celestial sphere overhead.

Zenith Distance - The co-latitude coordinate in the horizon system, the complement of the altitude.

Zenith Tube - A special type of meridian circle used to observe stars near the zenith.

Zodiac - The band of width $\sim 16^\circ$ on the celestial sphere about the ecliptic.

Zodiacal Light - A faint glow sometimes visible after dusk in the west or before dawn in the east near the ecliptic.

Zone Time - The mean solar time, kept constant over a $\sim 15^\circ$ longitude belt.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) At various times during the development of the GEODSS system it became clear that a common, technical vocabulary could be a useful thing. There are many precisely defined astronomical quantities one needs to intelligently discuss star catalogs, optical data reduction, orbital analysis, photometry, etc. Partially as an outgrowth of this need but mostly through the impetus of my forthcoming reference work, this Glossary was assembled. Its orientation is heavily toward astrometry rather than astronomy or astrophysics. Also it is frequently difficult to give precise and concise definitions. In some cases it is impossible to provide the precise meaning without complicated formulas and much discussion. Nevertheless, sometimes sacrificing clarity for brevity and with a minimum of mathematics, the following ~800 items are presented.		

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