GLOSSARY
OF
ASTRONOMY
AND
ASTROPHYSICS

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Jeanne Hopkins

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Foreword

The task of a copy editor of a scientific journal is in many ways an impossible one: to contend with the "illiteracies" (in the technical sense of Fowler) of an author without encroaching on his omniscience of scientific jargon is to walk a tightrope, requiring all the skill of an acrobat. Miss Jeanne Hopkins, who has edited the manuscripts for the *Astrophysical Journal* for many years now, has attempted to lighten her task by a genuine and an earnest desire to understand the meanings of the terms which the authors use while comprehending their content. With these latter objectives in view, she started compiling a glossary of the most commonly used astronomical and astrophysical terms, often transcribing the definitions given by different authors and asking me to referee (while I was still the Managing Editor) to resolve the conflicts which often arose. The glossary she started compiling in this fashion soon grew, and authors and editors to whom she showed the glossary were enthusiastic and recommended its publication. The present glossary arose in this way.

Clearly to compile a glossary that will stand the scrutiny of a tyro will require an astronomer of considerable scholarship; and it is quite unlikely that one with the requisite wide and detailed knowledge would want to take the time and effort. But Miss Hopkins, with the encouragement of several author-friends, has compiled a glossary with effectively the assistance of all the distinguished astronomers of this country through their papers in the *Astrophysical Journal*. I am sure that errors which may have crept into the glossary could be traced to one or other author in the *Astrophysical Journal!* But I am equally sure that when such an error is pointed out to Miss Hopkins, her response would be the same as Dr. Johnson's (when asked by a lady why he defined "pastern" as the "knee" of a horse, in his dictionary): "Ignorance, madam, pure ignorance."

Miss Hopkins deserves the thanks of all astronomers for her noble efforts in compiling this useful and valuable glossary.

S. Chandrasekhar

Acknowledgment

When I first started copyediting the *Astrophysical Journal* eight years ago, I felt like the girl in *Born Yesterday*. Many of the words either were totally unfamiliar or had a meaning different from any given in standard dictionaries. From sheer necessity I started compiling a list. Whenever I came across a felicitous explanation in a manuscript I was editing, I copied it down, frequently—and I now regret it—without citing the source. This compilation has become my vade mecum at work, and I hope it will prove a convenient quick reference for others. I would appreciate being informed of errors which have undoubtedly crept in.

I am grateful to the many *Astrophysical Journal* authors whose words I have quoted or paraphrased, and especially to the astronomers at the University of Chicago, who have patiently and graciously explained some abstruse term when I called them. I am deeply indebted to Dr. Dimitri Mihalas, who critically revised an earlier version of this glossary, and also to Professors David Van Blerkom and Thomas Adams for checking a later version and to Professor David Schramm for checking and rewriting many of the nucleosynthesis entries.

Most of all I want to express my deepest appreciation to Professor S. Chandrasekhar for initially communicating to me some of the fascination and excitement of astronomy, and for the many hours he spent going over the theoretical entries in the final version.

Jeanne Hopkins

A

A band   See Fraunhofer lines.

A-coefficient   See Einstein coefficient.

A-number   See atomic mass number.

A star   A star of spectral type A with a surface temperature of about 10,000 K, in whose spectrum the Balmer lines of hydrogen attain their greatest strength. Helium lines can no longer be seen. Some metallic lines are present; in late A stars the H and K lines of ionized calcium appear. A0 stars have a color index of zero. Examples of A stars are Vega and Sirius.

***ab* variables**   See Bailey types.

Am stars   Peculiar stars whose metallic lines are as strong as those of the F stars but whose hydrogen lines are so strong as to require that they be classed with the A stars. They are generally short-period ($<300^d$) spectroscopic binaries with high atmospheric turbulence and variable spectra, and are slower rotators than normal A stars.

Ap stars   Peculiar A-type stars ("magnetic" A stars) that show abnormally strong lines, sometimes of varying intensity, of certain ionized metals. Recent evidence indicates that all Ap stars are slow rotators compared with normal A stars.

aberration (of starlight)   Angular displacement in the apparent direction of a star, due to Earth's orbital motion (v_E) and the finite speed of light (c). The displacement $\theta = \arctan(v_E/c) \approx 20.49$. Thus to an Earth-based observer a star describes an ellipse on the celestial sphere with a semimajor axis of 20.49. (The eccentricity of the ellipse is zero — i.e., a circle — for a star on the ecliptic pole; for a star on the ecliptic plane the ellipse degenerates into a straight line.)

aberration (of an optical system)   Failure of a lens or mirror to achieve exact point-to-point correspondence between the object and the image.

ablation   Erosion of an object (generally a meteorite) by the friction generated when it passes through the Earth's atmosphere.

absolute magnitude (*M*)   Apparent magnitude that a star would have at a standard distance of 10 parsecs without absorption. The absolute magnitude of the Sun is $+4.85$. The absolute magnitude (g) of a solar-system body such as an asteroid is defined as

the brightness at zero phase angle when the object is 1 AU from the Sun and 1 AU from the observer.

absolute zero   The point ($-273.16°$ C; 0 K) at which all thermal motion ceases and no heat is radiated.

absorption   Decrease in the intensity of radiation, representing energy converted into excitation or ionization of electrons in the region through which the radiation travels. As contrasted with monochromatic scattering (in which reemission occurs in all directions at the same frequency), the inverse process of emission refers to radiation that is reemitted in general in all directions and at all frequencies.

absorption coefficient (κ or k in cm^{-1})   Fraction of the incident radiation absorbed at a certain wavelength per unit thickness of the absorber. The absorption coefficient is in general a function of temperature, density, and chemical composition.

absorption edges   Sudden rises superposed on the smooth decrease of the curve of the attenuation coefficient, which cause the curve to have a typical sawtooth aspect. They generally occur at the limit of spectral lines.

absorption spectrum   Dark lines superposed on a continuous spectrum, caused by the absorption of light passing through a gas of lower temperature than the continuum light source.

accretion   A process by which a star accumulates matter as it moves through a dense cloud of interstellar gas; or, more generally, whereby matter surrounding a star flows toward it (as in close binaries).

Achernar (α Eridani)   A subgiant of spectral type B5, about 35 pc distant.

Achilles   Asteroid No. 588, a Trojan $60°$ ahead of Jupiter ($P = 11.98$ yr, $a = 5.2$ AU, $e = 0.15$, $i = 10.3$). It was the first Trojan to be discovered (in 1906).

achromatic objective   A lens of two or more components with different refraction indices (e.g., crown glass and flint glass), used to correct for chromatic aberration.

active galaxy   See violent galaxy. Active galactic nuclei are very luminous ($10^{43}-10^{46}$ ergs s^{-1}). Their energy output is in two forms: nonthermal continuum and thermal emission line.

active Sun   The Sun during its 11-year cycle of activity when spots, flares, prominences, and variations in radiofrequency radiation are at a maximum.

adiabatic index (γ)   The ratio of the fractional change in pressure to the fractional change in density as an element of fluid expands

(or contracts) without exchange of heat with its surroundings.

advance of the perihelion   The slow rotation of the major axis of a planet's orbit in the same direction as the revolution of the planet itself, due to gravitational interactions with other planets and/or other effects (such as those due to general relativity).

aerolite (lit. "air stone.")   A stony meteorite, composed primarily of silicates. About 93 percent of all known falls are aerolites. They include the carbonaceous chondrites, other chondrites, and achondrites.

airglow (also called nightglow)   Light in the nighttime sky caused by the collision of atoms and molecules (primarily oxygen, OH, and Ne) in Earth's geocorona with charged particles and X-rays from the Sun or outer space. The airglow varies with time of night, latitude, and season. It is a minimum at zenith and maximum about $10°$ above the horizon.

air shower   A proliferation of secondary cosmic rays initiated either by primary cosmic rays or by high-enery (10^{14} eV) gamma rays.

albedo   Ratio of the total flux reflected in all directions to the total incident flux. (See Bond albedo; geometric albedo.)

Alcyone (η Tau)   The brightest star in the Pleiades (spectral type B5).

Aldebaran (α Tau)   A K5 III subgiant (a foreground star in the Hyades), about 21 parsecs distant. It has a faint M2 V companion. It is now known to be slowly and irregularly variable.

Alfvén speed (or Alfvén velocity) (v_A)   The speed at which hydromagnetic waves are propagated along a magnetic field: (v_A) = $B/(4\pi\rho)^{1/2}$.

Alfvén waves   Waves moving perpendicularly through a magnetic field. They are caused by the oscillation of magnetic lines of force by the motions of the fluid element around its equilibrium position, which in turn is caused by the interactions between density fluctuations and magnetic variations.

Algol (β Per)   An eclipsing system of at least three components (B8 V, K0, Am), about 25 pc distant. Period of components A and B is about 68.8 hours; period of components A, B, and C is about 1.9 years. Long term observations also indicate a massive, unseen fourth component with a period of about 190 years. Algol is also an erratic radio source of about 0.5 AU diameter.

aliasing   In a discrete Fourier transform, the overlapping of replicas of the basic transform, usually due to undersampling.

α-particle   The nucleus of a ^{4}He atom, consisting of two protons and two neutrons. Mass of α-particle 4.00260 amu.

α-particle nuclei   Nuclei formed by the α-process (q.v.)(see even-even nuclei).

α-process   A hypothetical process of nucleosynthesis (now considered obsolete terminology), which consisted of redistributing α-particles in the region from ^{20}Ne to ^{56}Fe (and perhaps slightly higher). The α-process has been replaced by explosive and nonexplosive C, O, and Si burning occurring in rapidly evolving or even explosive stages of stellar evolution which at higher temperatures and densities becomes the e-process (q.v.).

Altair (α Aql)   A bright ($m_v = 0.78$) A7 V star about 4.8 pc distant.

amagat   A unit of molar volume at 0° C and a pressure of 1 atmosphere. This unit varies slightly from one gas to another, but in general it corresponds to 2.24×10^4 cm^3. Also, a unit of density equal to 0.0446 gram mole per liter at 1 atm pressure.

Amalthea   Jupiter V, the innermost satellite of Jupiter. Diameter about 140 km; $i = 0.4$, $e = 0.0028$, period 0.498 days. Discovered by Barnard in 1892.

ampere   The SI unit of electric current. "The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per meter of length" (CIPM [1946], Resolution 2, approved by the 9th CGPM 1948). A current of 1 A is equivalent to the passage along the filament of a light bulb of about 6×10^{18} electronic charges per second.

amplitude (of wave motion)   Maximum displacement from the equilibrium position.

Andromeda Galaxy (M31, NGC 224)   A spiral galaxy (Sb in Hubble's classification; kS5 in Morgan's classification) in the Local Group, about 650–700 kpc distant ($M_V = -21$), visible to the naked eye as a fuzzy patch in the constellation of Andromeda. Total mass about $3.1 \times 10^{11} M\odot$; $i = 77°$, heliocentric velocity -180 km s^{-1}. Its nucleus exhibits noncircular gas motions. It is similar to but slightly larger than our Galaxy.

Andromeda I, II, III   Three dwarf spheroidal galaxies, in the Andromeda subgroup of the Local Group, discovered by van den Bergh in 1972. They are the intrinsically faintest members of the Local Group.

S Andromedae   A supernova seen in 1885 in the Andromeda Galaxy.

angstrom unit (A)   A unit of length equal to 10^{-8} cm used in measuring wavelengths. 1 Å is about the diameter of a hydrogen atom (the diameter of a human hair is roughly 500,000 Å).

angular momentum (l or L)   The angular momentum of a system about

a specified origin is the sum over all the particles in the system (or an integral over the different elements of the system if it is continuous) of the vector products of the radius vector joining each particle to the origin and the momentum of the particle. For a closed system it is conserved by virtue of the isotropy of space.

annihilation   See pair annihilation.

annular eclipse   An eclipse of the Sun in which the Moon is too far from Earth to block out the Sun completely, so that a ring of sunlight appears around the Moon.

anomalistic month   The interval (27.555 days) between two successive perigee passages of the Moon.

anomalistic year   The interval (365.2596 ephemeris days) between two successive perihelion passages of Earth.

anomalous Zeeman effect   Splitting of spectral lines into several components, in contrast to the normal Zeeman effect which results in only two distinct components. The anomalous Zeeman effect is due to the fact that the electrons in the magnetic field have opposite directions of spin.

anomaly   An angular value used to describe the position of one member of a binary system with respect to the other. The true anomaly of a star is the angular distance (as measured from the central body and in the direction of the star's motion) between periastron and the observed position of the star. The mean anomaly is the angular distance (measured in the same manner) between periastron and a fictitious body in the direction of the star, which is moving in a circular orbit with a period equal to that of the star.

ansae   The "handles," or extremities, of Saturn's rings as viewed from Earth; also, the extremities of a lenticular galaxy.

antalgol star   An old name for an RR Lyrae star.

antapex   The direction in the sky (in Columba) away from which the Sun seems to be moving (at a speed of 19.4 km s^{-1}) relative to general field stars in the Galaxy.

Antares (α Sco)   A red M1 Ib supergiant, about 125 parsecs distant. It has a B3 V companion, which is a radio source.

antenna gain   A measure of the directivity of a radio telescope. It is the ratio of the amount of power received in the direction the dish is pointing to the smaller amount of power from other directions in the sidelobes.

antenna temperature   A term used to describe the strength of a signal

received from a radio source. It is the convolution of the true brightness distribution and the effective area of the antenna.

anticenter   The direction of the sky (in Auriga) opposite to that toward the center of the Milky Way.

anticoincidence counter   A particle counter in which the circuit has been designed so as not to register the passage of an ionizing particle through more than one counting tube.

antimatter   See antiparticle.

antiparticle   The absence of a particle in an otherwise infinite sea of negative energy.

apastron   The point in the orbit of one component of a binary system where it is farthest from the other.

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

aperture efficiency (η_A)   The ratio of the effective aperture of the antenna, A, to its geometric aperture, $A_g = \pi d^2/4$. The beam and aperture efficiencies are related by $\eta_A = \eta_B \lambda^2/A_g\Omega_M$, where Ω_M is the solid angle of the main beam.

aperture function   In radio astronomy, a distribution of direction assignments applying to a uniform background.

aperture ratio (f)   The ratio of the aperture of a telescope to the focal length.

aperture synthesis   The spreading of parts of an antenna system over a pattern at several different distances while preserving the total collecting area of the system, in order to achieve better resolution. The technique employs one arm of a Mills cross and a small movable antenna that successively occupies the positions of the elements of the second arm of the cross.

apex   See solar apex.

aphelion   In the orbit of a solar system body, the most distant point from the Sun.

aplanatic system   A system of three lenses which, taken together, correct for spherical aberration, chromatic aberration, and coma.

apocenter   The point in the orbit of one component of a binary system which is farthest from the center of mass of the system.

apodization   A mathematical process performed on the data received from an interferometer before carrying out the calculations of the Fourier transformation to obtain the spectrum, in order to modify the instrumental response function.

Apollo asteroid   One of a small group of asteroids whose orbits intersect that of Earth. They are named for the prototype, Apollo ($P = 622^d$, $a = 1.486$ AU, $e = 0.57$, $i = 6°.4$).

apparent magnitude ($m,$)   Measure of the observed brightness of a celestial object as seen from the Earth. It is a function of the star's intrinsic brightness, its distance from the observer, and the amount of absorption by interstellar matter between the star and the observer. The m_v of Sun, -26.5. A sixth-magnitude star is just barely visible to the naked eye.

apparent solar day   Interval between two successive culminations of the Sun — i.e., the period from apparent noon to apparent noon. The apparent solar day is longest in late December.

apparition   The period during which a celestial body is visible.

Appleton layers   See F layers.

appulse   A penumbral eclipse of the Moon.

apsidal motion   Rotation of the line of apsides (q.v.) in the plane of the orbit; (in a binary) precession of the line of apsides due to mutual tidal distortion.

apsides, line of   The major axis of an elliptical orbit.

arc spectra   The spectra of neutral atoms produced in a laboratory arc (cf. spark spectra).

Arcturus (α Boo)   An old subgiant disk star (K2 IIIp, $m_v = 0.06$) about 11 pc distant.

areas, law of   See Kepler's second law.

Argelander method (also called step method)   A method of classifying stars according to image size. If the sequence stars are labeled a, b, etc., in order of image size and if the image size of a variable appears to be, say, 0.7 of the way from sequence star a to sequence star b, its brightness is listed as $a7b$.

argument of the perihelion (ω)   Angular distance (measured in the plane of the object's orbit and in the direction of its motion) from the ascending node to the perihelion point.

Ariel   Second satellite of Uranus about 1600 km in diameter, discovered by Lassell in 1851. Period 2.52 days.

arm population   Young stars typical of those found in spiral arms (Population I stars).

array   In radio astronomy, an arrangement of antenna elements designed to produce a particular antenna pattern.

arrival time   See dispersion.

ascending node   In the orbit of a solar-system body, the point where the body crosses the ecliptic from south to north; for a star, out of the plane of the sky *toward* the observer.

ashen light   A faint glow from the unlit side of Venus when it is in the crescent phase. Its cause is unknown; it may be the Venusian analog to terrestrial airglow.

aspect ratio   Ratio of the major axis (e.g., of a rocket) to the minor axis. (Of a fusion device) ratio of the plasma diameter to the major diameter of the torus.

association   A sparsely populated grouping (mass range 10^2–10^3 $M\odot$) of very young, massive stars lying along a spiral arm of the Milky Way, whose spectral types or motions in the sky indicate a common origin. The star density is insufficient for gravitation to hold the group together against shear by differential galactic rotation, but the stars have not yet had time to disperse completely. OB associations are composed of stars of spectral types O-B2; T associations have many young T Tauri stars. The internationally approved designation for associations is the name of the constellation followed by an arabic numeral—e.g., Perseus OB2.

asteroid (also called minor planet)   A small planet-like body of the solar system, $\langle e \rangle \sim 0.15$, $\langle i \rangle \sim 9°.7$. More than 1800 have been catalogued, and probably millions of smaller ones exist, but their total mass would probably be less than 3 percent that of the Moon. Their densities are poorly known (about 2.6 g cm^{-3}), but they suggest a composition similar to carbonaceous chondrite. The bright asteroids are presumably original condensations and those fainter than about 14–15 mag are collision fragments. Asteroids and short-period comets have some orbital similarities.

asteroid belt   A region of space lying between Mars (1.5 AU) and Jupiter (5.2 AU), where the great majority of the asteroids are found. *None* of the belt asteroids have retrograde motion.

astigmatism   An aberration in optical systems produced when the object is far off axis (farther than in coma) and pairs of light rays in a single object plane do not focus in the same image plane.

astration   The processing of matter through stars.

astrometric binaries   See binary system.

astrometry   Measurement of the precise positions and motions of stars.

astronomical twilight   The period from sunset to the time that the Sun is 18° below the horizon; or the corresponding period before sunrise.

astronomical unit (AU)   The mean distance between the Earth and the Sun. The astronomical unit is defined as the length of the radius of the unperturbed circular orbit of a body of negligible mass moving around the Sun with a sidereal angular velocity of 0.017202098950 radian per day of 86,400 ephemeris seconds. 1

AU = 1.496×10^{13} cm $\approx$ 500 lt-sec.

atmosphere   Unit of pressure. 1 atm = 1.013 bars.

atmosphere (solar)   The gaseous outer layers of the Sun, including, from the deeper layers outward, the photosphere, the chromosphere, and the corona. The atmosphere constitutes those layers of the Sun that can be observed directly.

atmospheric extinction   Decrease in the intensity of light from a celestial body due to absorption and scattering by the Earth's atmosphere. The extinction increases from the zenith to the horizon and affects short wavelengths more than long wavelengths, so that objects near the horizon appear redder than they are at the zenith.

atomic mass number (A-number)   The number of protons plus neutrons in the nucleus of an atom.

atomic mass unit (amu)   In the notation of physics, adopted by international agreement in 1961, one-twelfth the mean mass of an atom of ^{12}C (including the orbital electrons). Because of the mass defect (q.v.), the amu is slightly less than the mass of a hydrogen atom, so one H atom has 1.007825 amu. 1 amu = 1.66 $\times 10^{-24}$ g. The energy equivalent of 1 amu is 931 MeV.

atomic number (Z-number) (also called charge number)   The number of protons in an atomic nucleus.

atomic time   Time based on the atomic second (see second). Atomic time was officially adopted 1972 January 1. From 1972 January 1 to 1974 January 1, 3 leap seconds had to be introduced to keep atomic time within 0.7 seconds of Universal Time.

atomic weight   The mean atomic mass of a particular element in atomic mass units.

attenuation   The falling off of the energy density of radiation with distance from the source, or with passage through an absorbing or scattering medium.

attenuation factor   In a rocket-borne or satellite-borne telescope, the ratio of the expected counting rate to the observed counting rate.

attitude   Position of a rocket with respect to the horizon or some other fixed reference plane.

atto-   A prefix meaning 10^{-18}.

AU   See astronomical unit.

Auger effect   A radiationless quantum jump that occurs in the X-ray region. When a K-electron is removed from an atom and an L-electron drops into the vacancy in the K-shell, the energy released in the latter transition goes not into radiation, but into the

liberation of one of the remaining L-electrons.

AE Aurigae   An O9.5 V runaway star (q.v.).

α **Aurigae**   See Capella.

ε **Aurigae**   An eclipsing binary with an invisible supergiant compan-
ion. The primary is an extremely luminous A8 Ia supergiant of
$30 M\odot$ in a post-main-sequence stage of evolution; the second-
ary may be a collapsed star or black hole. The period of the
system is about 27 years. Probably on the order of 1 kpc distant.
It has at least six components.

RW Aurigae   A dG5e T Tauri star with a strong ultraviolet excess.

ζ **Aurigae stars**   In general, binaries with a K supergiant primary and
a main-sequence secondary.

aurora   Light radiated by ions in the Earth's atmosphere, mainly near
the geomagnetic poles, stimulated by bombardment by energetic
particles ejected from the Sun (see solar wind). Aurorae appear
about 2 days after a solar flare and reach their peak about 2
years after sunspot maximum.

autoionization (also called preionization)   A phenomenon occurring
when a discrete double-excitation state of an atom lies in the
ground-state continuum. In the autoionization process one of
the excited electrons is ejected, leaving the ion in an excited state
(see dielectronic recombination; see also Auger effect).

average life   See mean life.

Avogadro's number (6.02×10^{23})   The number of atoms in 12 grams
of ^{12}C; by extension, the number of atoms in a gram-atom (or
the number of molecules in a mole) of any substance.

azimuth   Angular distance from the north point eastward to the inter-
section of the celestial horizon with the vertical circle passing
through the object and the zenith.

azimuthal quantum number (k)   A measure of the minor axis of an
elliptic orbital of an electron according to the Bohr-Sommerfeld
theory.

B

B band   See Fraunhofer lines.

B-coefficient   See Einstein coefficient.

B galaxy   In Morgan's classification, a barred spiral.

b-lines   A triplet of spectral lines of neutral magnesium λλ5167-5184.

B star   Stars of spectral type B are blue-white stars with surface tem-

peratures of about 11,000–28,000 K, whose spectra are characterized by absorption lines of neutral helium which reach their maximum intensity at B2. The Balmer lines of hydrogen are strong, and lines of singly ionized oxygen and other gases are also present. Examples are Rigel and Spica.

Ba II stars (also called barium stars) Peculiar low-velocity, strong lined red-giant stars of spectral types G, K, and M, with abnormally large abundances of heavy s-process (but not r-process) elements. They are usually regarded as old disk stars of ~ 1–2 $M \odot$.

background count Unwanted counts due to background noise that must be subtracted from an observed number of counts in an experiment where atomic or nuclear particles coming from a source are being enumerated.

background noise All the interference effects in a system which is producing, measuring, or recording a signal. Natural background noises arise from (a) galactic noise (synchrotron radiation), (b) thermal noise (receiver and isotropic background noise), (c) quantum noise (spontaneous emission or shot noise), and (d) star noise.

backscatter Scattering of radiation (or particles) through angles greater than 90° with respect to the original direction of motion.

back warming Heating of deeper layers due to overlying opacity.

Bailey types A classification of RR Lyrae stars according to the shape and amplitude of their light variation (a, b, and c, although today types a and b are usually combined). The c-type stars have the smallest amplitude. (RRa: sharp rise to maximum; slow fall to minimum. RRc: Rise and fall equally long.)

Baily's beads Small "beads" of sunlight (the "diamond ring" effect) which shine through the valleys on the limb of the Moon in the instant before (or after) totality in a solar eclipse. Named after the English astronomer Francis Baily who first observed them in 1836.

Baldet-Johnson bands Spectral bands of the CO^+ radical.

Ballik-Ramsay bands Spectral bands of the C_2 radical in the near infrared (0–0 at 1.7625 μ).

Balmer formula A formula which represents the wavelengths of the various spectral series of hydrogen: $\lambda^{-1} = R(m^{-2} - n^{-2})$. The Balmer series is obtained by putting m equal to 2; the Lyman series by putting m equal to 1 (see Rydberg formula).

Balmer jump (also called Balmer discontinuity) The sudden decrease in the intensity of the continuous spectrum at the limit of the

Balmer series of hydrogen at 3646 Å, representing the energy absorbed when electrons originally in the second energy level are ionized.

Balmer series   The spectral series associated with the second energy level of the hydrogen atom. The series lies in the visible portion of the spectrum. The transition from the third level to the second level yields the red Hα emission line at 6563 Å; Hβ is at 4861 Å; Hγ, at 4342 Å; Hδ, at 4101 Å. (Deuterium Hα is 1.785 Å shortward of hydrogen Hα.) He II Hα is at 1640 Å.

Bamberga   Asteroid 324 ($a = 2.80$ AU, $e = 0.36$, $i = 11°2$). It is among the darkest known surfaces in the solar system. It is the only minor planet known to have an albedo less than 5 percent, and some astronomers think it may be larger than Pallas. Mean opposition magnitude $+11.41$, absolute magnitude $+8.14$. Rotation period 8^h(?). Meteorite class: carbonaceous chondrite.

band (molecular)   A series of closely spaced, often unresolved, emission or absorption lines found in the spectra of molecules. Each line represents an increment of energy due to a change in the rotational state of the molecule.

band head   The conspicuous sharp boundary which usually occurs at the head of a molecular band and which fades gradually toward either longer or shorter wavelengths, depending on the quadratic relation between frequency and rotational quantum number.

bandpass filter   A device used in radio astronomy for suppressing signals of unwanted frequencies without appreciably affecting the desired frequencies.

bandwidth   The width of the portion of the electromagnetic spectrum (the range of frequencies) that is permitted to pass through an electronic device (measured in cycles per second).

bar   The absolute cgs unit of pressure equal to 10^6 dyn cm^{-2}.

barium stars   See Ba II stars.

barn   A unit of area equal to 10^{-24} cm^2 used in measuring cross sections.

Barnard's loop   A huge nebular shell around the central portion of Orion.

Barnard's satellite   See Amalthea.

Barnard's star (BD+4°3561)   A faint M5 V optical binary (period about 25 years) about 1.83 pc distant ($\pi = 0°548$) in the constellation of Ophiuchus. It has the largest proper motion known ($10°25$ per annum). Long-term observations of its light curve suggest a possible third component with a mass about 1.2 that of Jupiter, although this observation has been challenged.