

Glossary

absorption spectrum | a series or pattern of dark lines superimposed on a continuous spectrum

accelerate | to change velocity; to speed up, slow down, or change direction.

accretion | the gradual accumulation of mass, as by a planet forming from colliding particles in the solar nebula

accretion disk | the disk of gas and dust found orbiting newborn stars, as well as compact stellar remnants such as white dwarfs, neutron stars, and black holes when they are in binary systems and are sufficiently close to their binary companions to draw off material

active galactic nuclei | galaxies that are almost as luminous as quasars and share many of their properties, although to a less spectacular degree; abnormal amounts of energy are produced in their centers

active galaxies | galaxies that house active galactic nuclei

active region | an area on the Sun where magnetic fields are concentrated; sunspots, prominences, flares, and CMEs all tend to occur in active regions

adaptive optics | systems used with telescopes that can compensate for distortions in an image introduced by the atmosphere, thus resulting in sharper images

amino acids | organic compounds that are the molecular building blocks of proteins

angular momentum | the measure of the motion of a rotating object in terms of its speed and how widely the object's mass is distributed around its axis

aperture | diameter of the primary lens or mirror of a telescope

aphelion | the point in its orbit where a planet (or other orbiting object) is farthest from the Sun

apogee | the point in its orbit where an Earth satellite is farthest from Earth

apparent brightness | a measure of the amount of light received by Earth from a star or other object—that is, how bright an object appears in the sky, as contrasted with its luminosity

apparent magnitude | a measure of how bright a star looks in the sky; the larger the number, the dimmer the star appears to us

apparent solar time | time as measured by the position of the Sun in the sky (the time that would be indicated by a sundial)

association | a loose group of young stars whose spectral types, motions, and positions in the sky indicate a common origin

asteroid | a stony or metallic object orbiting the Sun that is smaller than a major planet but that shows no evidence of an atmosphere or of other types of activity associated with comets

asteroid belt | the region of the solar system between the orbits of Mars and Jupiter in which most asteroids are located; the main belt, where the orbits are generally the most stable, extends from 2.2 to 3.3 AU from the Sun

astrobiology | the multidisciplinary study of life in the universe: its origin, evolution, distribution, and fate; similar terms are exobiology and bioastronomy

astrology | the pseudoscience that deals with the supposed influences on human destiny of the configurations and locations in the sky of the Sun, Moon, and planets

astronomical unit | the unit of length defined as the average distance between Earth and the Sun; this distance is about 1.5×10^8 kilometers

aurora | light radiated by atoms and ions in the ionosphere excited by charged particles from the Sun, mostly seen in the magnetic polar regions

bar | a force of 100,000 Newtons acting on a surface area of 1 square meter; the average pressure of Earth's atmosphere at sea level is 1.013 bars

baryon cycle | the cycling of mass in and out of the interstellar medium, including accretion of gas from intergalactic space, loss of gas back into intergalactic space, and conversion of interstellar gas into stars

basalt | igneous rock produced by the cooling of lava; makes up most of Earth's oceanic crust and is found on other planets that have experienced extensive volcanic activity

Big Bang | the theory of cosmology in which the expansion of the universe began with a primeval explosion (of space, time, matter, and energy)

binary stars | two stars that revolve about each other

biomarker | evidence of the presence of life, especially a global indication of life on a planet that could be detected remotely (such as an unusual atmospheric composition)

black hole | a region in spacetime where gravity is so strong that nothing—not even light—can escape

blackbody | an idealized object that absorbs all electromagnetic energy that falls onto it

brown dwarf | an object intermediate in size between a planet and a star; the approximate mass range is from about 1/100 of the mass of the Sun up to the lower mass limit for self-sustaining nuclear reactions, which is about 0.075 the mass of the Sun; brown dwarfs are capable of deuterium fusion, but not hydrogen fusion

celestial equator | a great circle on the celestial sphere 90° from the celestial poles; where the celestial sphere intersects the plane of Earth's equator

celestial poles | points about which the celestial sphere appears to rotate; intersections of the celestial sphere with Earth's polar axis

celestial sphere | the apparent sphere of the sky; a sphere of large radius centered on the observer; directions of objects in the sky can be denoted by their position on the celestial sphere

central bulge | (or nuclear bulge) the central (round) part of the Milky Way or a similar galaxy

cepheid | a star that belongs to a class of yellow supergiant pulsating stars; these stars vary periodically in brightness, and the relationship between their periods and luminosities is useful in deriving distances to them

Chandrasekhar limit | the upper limit to the mass of a white dwarf (equals 1.4 times the mass of the Sun)

charge-coupled device | array of high-sensitivity electronic detectors of electromagnetic radiation, used at the focus of a telescope (or camera lens) to record an image or spectrum

chromatic aberration | distortion that causes an image to appear fuzzy when each wavelength coming into a transparent material focuses at a different spot

chromosphere | the part of the solar atmosphere that lies immediately above the photospheric layers

circumpolar zone | those portions of the celestial sphere near the celestial poles that are either always above or always below the horizon

closed universe | a model in which the universe expands from a Big Bang, stops, and then contracts to a big crunch

cold dark matter | slow-moving massive particles, not yet identified, that don't absorb, emit, or reflect light or other electromagnetic radiation, and that make up most of the mass of galaxies and galaxy clusters

color index | difference between the magnitudes of a star or other object measured in light of two different spectral regions—for example, blue minus visual (B–V) magnitudes

comet | a small body of icy and dusty matter that revolves about the Sun; when a comet comes near the Sun, some of its material vaporizes, forming a large head of tenuous gas and often a tail

conduction | process by which heat is directly transmitted through a substance when there is a difference of temperature between adjoining regions caused by atomic or molecular collisions

continuous spectrum | a spectrum of light composed of radiation of a continuous range of wavelengths or colors, rather than only certain discrete wavelengths

convection | movement caused within a gas or liquid by the tendency of hotter, and therefore less dense material, to rise and colder, denser material to sink under the influence of gravity, which consequently results in transfer of heat

core | the central part of the planet; consists of higher density material

corona | (of the Sun) the outer (hot) atmosphere of the Sun

coronal hole | a region in the Sun's outer atmosphere that appears darker because there is less hot gas there

coronal mass ejection | a solar flare in which immense quantities of coronal material—mainly protons and electrons—is ejected at high speeds (500–1000 kilometers per second) into interplanetary space

cosmic microwave background | microwave radiation coming from all directions that is the redshifted afterglow of the Big Bang

cosmic rays | atomic nuclei (mostly protons) and electrons that are observed to strike Earth's atmosphere with exceedingly high energies.

cosmological constant | the term in the equations of general relativity that represents a repulsive force in the universe

cosmological principle | the assumption that, on the large scale, the universe at any given time is the same everywhere—isotropic and homogeneous

cosmology | the study of the organization and evolution of the universe

critical density | in cosmology, the density that is just sufficient to bring the expansion of the universe to a stop after infinite time

crust | the outer layer of a terrestrial planet

dark energy | the energy that is causing the expansion of the universe to accelerate; its existence is inferred from observations of distant supernovae

dark matter | nonluminous material, whose nature we don't yet understand, but whose presence can be inferred because of its gravitational influence on luminous matter

dark matter halo | the mass in the Milky Way that extends well beyond the boundary of the luminous stars to a distance of at least 200,000 light-years from the center of the Galaxy; although we deduce its existence from its gravity, the composition of this matter remains a mystery

declination | the angular distance north or south of the celestial equator

degenerate gas | a gas that resists further compression because no two electrons can be in the same place at the same time doing the same thing (Pauli exclusion principle)

density | the ratio of the mass of an object to its volume

detector | device sensitive to electromagnetic radiation that makes a record of astronomical observations

deuterium | a form of hydrogen in which the nucleus of each atom consists of one proton and one neutron

differential galactic rotation | the idea that different parts of the Galaxy turn at different rates, since the parts of the Galaxy follow Kepler's third law: more distant objects take longer to complete one full orbit around the center of the Galaxy

differential rotation | the phenomenon that occurs when different parts of a rotating object rotate at different rates at different latitudes

differentiation | gravitational separation of materials of different density into layers in the interior of a planet or moon

dispersion | separation of different wavelengths of white light through refraction of different amounts

DNA | a molecule that stores information about how to replicate a cell and its chemical and structural components

Doppler effect | the apparent change in wavelength or frequency of the radiation from a source due to its relative motion away from or toward the observer

Drake equation | a formula for estimating the number of intelligent, technological civilizations in our Galaxy, first suggested by Frank Drake

eccentricity | in an ellipse, the ratio of the distance between the foci to the major axis

eclipsing binary | a binary star in which the plane of revolution of the two stars is nearly edge-on to our line of sight, so that the light of one star is periodically diminished by the other passing in front of it

ecliptic | the apparent annual path of the Sun on the celestial sphere

electromagnetic radiation | radiation consisting of waves propagated through regularly varying electric and magnetic fields and traveling at the speed of light

electromagnetic spectrum | the whole array or family of electromagnetic waves, from radio to gamma rays

ellipse | a closed curve for which the sum of the distances from any point on the ellipse to two points inside (called the foci) is always the same

elliptical galaxy | a galaxy whose shape is an ellipse and that contains no conspicuous interstellar material

emission spectrum | a series or pattern of bright lines superimposed on a continuous spectrum

energy flux | the amount of energy passing through a unit area (for example, 1 square meter) per second; the units of flux are watts per square meter

energy level | a particular level, or amount, of energy possessed by an atom or ion above the energy it possesses in its least energetic state; also used to refer to the states of energy an electron can have in an atom

epicycle | the circular orbit of a body in the Ptolemaic system, the center of which revolves about another circle (the deferent)

equivalence principle | concept that a gravitational force and a suitable acceleration are indistinguishable within a sufficiently local environment

escape speed | the speed a body must achieve to break away from the gravity of another body

event horizon | a boundary in spacetime such that events inside the boundary can have no effect on the world outside it—that is, the boundary of the region around a black hole where the curvature of spacetime no longer provides any way out

evolution of galaxies | changes in individual galaxies over cosmic time, inferred by observing snapshots of many different galaxies at different times in their lives

excitation | the process of giving an atom or an ion an amount of energy greater than it has in its lowest energy (ground) state

exoplanet | a planet orbiting a star other than our Sun

extremophile | an organism (usually a microbe) that tolerates or even thrives under conditions that most of the life around us would consider hostile, such as very high or low temperature or acidity

eyepiece | magnifying lens used to view the image produced by the objective lens or primary mirror of a telescope

fault | in geology, a crack or break in the crust of a planet along which slippage or movement can take place, accompanied by seismic activity

fission | breaking up of heavier atomic nuclei into lighter ones

flat universe | a model of the universe that has a critical density and in which the geometry of the universe is flat, like a sheet of paper

focus | (plural: foci) one of two fixed points inside an ellipse from which the sum of the distances to any point on the ellipse is constant

focus | (of telescope) point where the rays of light converged by a mirror or lens meet

frequency | the number of waves that cross a given point per unit time (in radiation)

fusion | the building of heavier atomic nuclei from lighter ones

galactic cannibalism | a process by which a larger galaxy strips material from or completely swallows a smaller one

gamma rays | photons (of electromagnetic radiation) of energy with wavelengths no longer than 0.01 nanometer; the most energetic form of electromagnetic radiation

gene | the basic functional unit that carries the genetic (hereditary) material contained in a cell

general theory of relativity | Einstein's theory relating gravity and the structure (geometry) of space and time

geocentric | centered on Earth

giant | a star of exaggerated size with a large, extended photosphere

giant molecular clouds | large, cold interstellar clouds with diameters of dozens of light-years and typical masses of 105 solar masses; found in the spiral arms of galaxies, these clouds are where stars form

giant planet | any of the planets Jupiter, Saturn, Uranus, and Neptune in our solar system, or planets of roughly that mass and composition in other planetary systems

globular cluster | one of about 150 large, spherical star clusters (each with hundreds of thousands of stars) that form a spherical halo around the center of our Galaxy

grand unified theories | (GUTs) physical theories that attempt to describe the four forces of nature as different manifestations of a single force

granite | a type of igneous silicate rock that makes up most of Earth's continental crust

granulation | the rice-grain-like structure of the solar photosphere; granulation is produced by upwelling currents of gas that are slightly hotter, and therefore brighter, than the surrounding regions, which are flowing downward into the Sun

gravitational redshift | an increase in wavelength of an electromagnetic wave (light) when propagating from or near a massive object

gravitational wave | a disturbance in the curvature of spacetime caused by changes in how matter is distributed; gravitational waves propagate at (or near) the speed of light

gravity | the mutual attraction of material bodies or particles

great circle | a circle on the surface of a sphere that is the curve of intersection of the sphere with a plane passing through its center

greenhouse effect | the blanketing (absorption) of infrared radiation near the surface of a planet—for example, by CO₂ in its atmosphere

ground state | the lowest energy state of an atom

H II region | the region of ionized hydrogen in interstellar space

habitable environment | an environment capable of hosting life

habitable zone | the region around a star in which liquid water could exist on the surface of terrestrial-sized planets, hence the most probable place to look for life in a star's planetary system

half-life | time required for half of the radioactive atoms in a sample to disintegrate

halo | the outermost extent of our Galaxy (or another galaxy), containing a sparse distribution of stars and globular clusters in a more or less spherical distribution

heliocentric | centered on the Sun

helioseismology | study of pulsations or oscillations of the Sun in order to determine the characteristics of the solar interior

helium flash | a nearly explosive ignition of helium in the triple-alpha process in the dense core of a red giant star

Herbig-Haro object | luminous knots of gas in an area of star formation that are set to glow by jets of material from a protostar

Hertzsprung–Russell diagram | (Hertzsprung–Russell diagram) a plot of luminosity against surface temperature (or spectral type) for a group of stars

highlands | the lighter, heavily cratered regions of the Moon, which are generally several kilometers higher than the maria

homogeneous | having a consistent and even distribution of matter that is the same everywhere

horizon | a great circle on the celestial sphere 90° from the zenith; more popularly, the circle around us where the dome of the sky meets Earth

horoscope | a chart used by astrologers that shows the positions along the zodiac and in the sky of the Sun, Moon, and planets at some given instant and as seen from a particular place on Earth—usually corresponding to the time and place of a person's birth

hot dark matter | massive particles, not yet identified, that don't absorb, emit, or reflect light or other electromagnetic radiation, and that make up most of the mass of galaxies and galaxy clusters; hot dark matter is faster-moving material than cold dark matter

Hubble constant | a constant of proportionality in the law relating the velocities of remote galaxies to their distances

Hubble's law | a rule that the radial velocities of remote galaxies are proportional to their distances from us

hydrostatic equilibrium | balance between the weights of various layers, as in a star or Earth's atmosphere, and the pressures that support them

igneous rock | rock produced by cooling from a molten state

inflationary universe | a theory of cosmology in which the universe is assumed to have undergone a phase of very rapid expansion when the universe was about 10–35 second old; after this period of rapid expansion, the standard Big Bang and inflationary models are identical

infrared | electromagnetic radiation of wavelength 10^3 – 10^6 nanometers; longer than the longest (red) wavelengths that can be perceived by the eye, but shorter than radio wavelengths

interference | process in which waves mix together such that their crests and troughs can alternately reinforce and cancel one another

interferometer | instrument that combines electromagnetic radiation from one or more telescopes to obtain a resolution equivalent to what would be obtained with a single telescope with a diameter equal to the baseline separating the individual separate telescopes

interferometer array | combination of multiple radio dishes to, in effect, work like a large number of two-dish interferometers

International Date Line | an arbitrary line on the surface of Earth near longitude 180° across which the date changes by one day

interstellar dust | tiny solid grains in interstellar space thought to consist of a core of rocklike material (silicates) or graphite surrounded by a mantle of ices; water, methane, and ammonia are probably the most abundant ices

interstellar extinction | the attenuation or absorption of light by dust in the interstellar medium

interstellar medium (ISM) | (or interstellar matter) the gas and dust between the stars in a galaxy

inverse square law | (for light) the amount of energy (light) flowing through a given area in a given time decreases in proportion to the square of the distance from the source of energy or light

ion | an atom that has become electrically charged by the addition or loss of one or more electrons

ionization | the process by which an atom gains or loses electrons

iron meteorite | a meteorite composed primarily of iron and nickel

irregular galaxy | a galaxy without any clear symmetry or pattern; neither a spiral nor an elliptical galaxy

isotope | any of two or more forms of the same element whose atoms have the same number of protons but different numbers of neutrons

isotropic | the same in all directions

Kepler's first law | each planet moves around the Sun in an orbit that is an ellipse, with the Sun at one focus of the ellipse

Kepler's second law | the straight line joining a planet and the Sun sweeps out equal areas in space in equal intervals of time

Kepler's third law | the square of a planet's orbital period is directly proportional to the cube of the semimajor axis of its orbit

Kuiper belt | a region of space beyond Neptune that is dynamically stable (like the asteroid belt); the source region for most short-period comets

light curve | a graph that displays the time variation of the light from a variable or eclipsing binary star or, more generally, from any other object whose radiation output changes with time

lithium | the third element in the periodic table; lithium nuclei with three protons and four neutrons were manufactured during the first few minutes of the expansion of the universe

Local Bubble | a region of low-density, million degree gas in which the Sun and solar system are currently located

Local Fluff | a slightly denser cloud inside the Local Bubble, inside which the Sun also lies

Local Group | a small cluster of galaxies to which our Galaxy belongs

luminosity | the rate at which a star or other object emits electromagnetic energy into space; the total power output of an object

luminosity class | a classification of a star according to its luminosity within a given spectral class; our Sun, a G2V star, has luminosity class V, for example

lunar eclipse | an eclipse of the Moon, in which the Moon moves into the shadow of Earth; lunar eclipses can occur only at the time of full moon

magnetosphere | the region around a planet in which its intrinsic magnetic field dominates the interplanetary field carried by the solar wind; hence, the region within which charged particles can be trapped by the planetary magnetic field

magnitude | an older system of measuring the amount of light we receive from a star or other luminous object; the larger the magnitude, the less radiation we receive from the object

main sequence | a sequence of stars on the Hertzsprung–Russell diagram, containing the majority of stars, that runs diagonally from the upper left to the lower right

main-sequence turnoff | location in the H–R diagram where stars begin to leave the main sequence

major axis | the maximum diameter of an ellipse

mantle | the largest part of Earth's interior; lies between the crust and the core

mare | (plural: maria) Latin for “sea;” the name applied to the dark, relatively smooth features that cover 17% of the Moon's surface

mass extinction | the sudden disappearance in the fossil record of a large number of species of life, to be replaced by fossils of new species in subsequent layers; mass extinctions are indicators of catastrophic changes in the environment, such as might be produced by a large impact on Earth

mass-luminosity relation | the observed relation between the masses and luminosities of many (90% of all) stars

mass-to-light ratio | the ratio of the total mass of a galaxy to its total luminosity, usually expressed in units of solar mass and solar luminosity; the mass-to-light ratio gives a rough indication of the types of stars contained within a galaxy and whether or not substantial quantities of dark matter are present

Maunder Minimum | a period during the eighteenth century when the number of sunspots seen throughout the solar cycle was unusually low

mean solar time | time based on the rotation of Earth; mean solar time passes at a constant rate, unlike apparent solar time

merger | a collision between galaxies (of roughly comparable size) that combine to form a single new structure

meridian | a great circle on the terrestrial or celestial sphere that passes through the poles

metamorphic rock | rock produced by physical and chemical alteration (without melting) under high temperature and pressure

meteor | a small piece of solid matter that enters Earth's atmosphere and burns up, popularly called a shooting star because it is seen as a small flash of light

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meteor shower | many meteors appearing to radiate from one point in the sky; produced when Earth passes through a cometary dust stream

meteorite | a portion of a meteor that survives passage through an atmosphere and strikes the ground

microwave | electromagnetic radiation of wavelengths from 1 millimeter to 1 meter; longer than infrared but shorter than radio waves

Milky Way Galaxy | the band of light encircling the sky, which is due to the many stars and diffuse nebulae lying near the plane of the Milky Way Galaxy

millisecond pulsar | a pulsar that rotates so quickly that it can give off hundreds of pulses per second (and its period is therefore measured in milliseconds)

mini-Neptune | a planet that is intermediate between the largest terrestrial planet in our solar system (Earth) and the smallest jovian planet (Neptune); generally, mini-Neptunes have sizes between 2.8 and 4 times Earth's size

molecular cloud | a large, dense, cold interstellar cloud; because of its size and density, this type of cloud can keep ultraviolet radiation from reaching its interior, where molecules are able to form

momentum | the measure of the amount of motion of a body; the momentum of a body is the product of its mass and velocity; in the absence of an unbalanced force, momentum is conserved

near-Earth asteroid | an Earth-approaching asteroid, one whose orbit could bring it on a collision course with our planet

near-Earth object | a comet or asteroid whose path intersects the orbit of Earth

nebula | a cloud of interstellar gas or dust; the term is most often used for clouds that are seen to glow with visible light or infrared

neutrino | fundamental particle that has no charge and a mass that is tiny relative to an electron; it rarely interacts with ordinary matter and comes in three different types

neutron star | a compact object of extremely high density composed almost entirely of neutrons

Newton's first law | every object will continue to be in a state of rest or move at a constant speed in a straight line unless it is compelled to change by an outside force

Newton's second law | the change of motion of a body is proportional to and in the direction of the force acting on it

Newton's third law | Newton's third law for every action there is an equal and opposite reaction (or: the mutual actions of two bodies upon each other are always equal and act in opposite directions)

nova | the cataclysmic explosion produced in a binary system, temporarily increasing its luminosity by hundreds to thousands of times

nucleosynthesis | the building up of heavy elements from lighter ones by nuclear fusion

nucleus (of a comet) | the solid chunk of ice and dust in the head of a comet

nucleus (of an atom) | the massive part of an atom, composed mostly of protons and neutrons, and about which the electrons revolve

Oort cloud | the large spherical region around the Sun from which most "new" comets come; a reservoir of objects with aphelia at about 50,000 AU

open cluster | a comparatively loose cluster of stars, containing from a few dozen to a few thousand members, located in the spiral arms or disk of our Galaxy; sometimes referred to as a galactic cluster

open universe | a model in which the density of the universe is not high enough to bring the expansion of the universe to a halt

orbit | the path of an object that is in revolution about another object or point

orbital period | the time it takes an object to travel once around the Sun

orbital speed | the speed at which an object (usually a planet) orbits around the mass of another object; in the case of a planet, the speed at which each planet moves along its ellipse

organic compound | a compound containing carbon, especially a complex carbon compound; not necessarily produced by life

organic molecule | a combination of carbon and other atoms—primarily hydrogen, oxygen, nitrogen, phosphorus, and sulfur—some of which serve as the basis for our biochemistry

ozone | (O_3) a heavy molecule of oxygen that contains three atoms rather than the more normal two

parallax | an apparent displacement of a nearby star that results from the motion of Earth around the Sun

parsec | a unit of distance in astronomy, equal to 3.26 light-years; at a distance of 1 parsec, a star has a parallax of 1 arcsecond

perigee | the point in its orbit where an Earth satellite is closest to Earth

perihelion | the point in its orbit where a planet (or other orbiting object) is nearest to the Sun

period-luminosity relation | an empirical relation between the periods and luminosities of certain variable stars

perturbation | a small disturbing effect on the motion or orbit of a body produced by a third body

phases of the Moon | the different appearance of light and dark on the Moon as seen from Earth during its monthly cycle, from new moon to full moon and back to new moon

photochemistry | chemical changes caused by electromagnetic radiation

photon | a discrete unit (or "packet") of electromagnetic energy

photon decoupling time | when radiation began to stream freely through the universe without interacting with matter

photosphere | the region of the solar (or stellar) atmosphere from which continuous radiation escapes into space

photosynthesis | a complex sequence of chemical reactions through which some living things can use sunlight to manufacture products that store energy (such as carbohydrates), releasing oxygen as one by-product

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plage | a bright region of the solar surface observed in the light of some spectral line

planet | today, any of the larger objects revolving about the Sun or any similar objects that orbit other stars; in ancient times, any object that moved regularly among the fixed stars

planetary nebula | a shell of gas ejected by and expanding away from an extremely hot low-mass star that is nearing the end of its life (the nebulae glow because of the ultra-violet energy of the central star)

planetesimals | objects, from tens to hundreds of kilometers in diameter, that formed in the solar nebula as an intermediate step between tiny grains and the larger planetary objects we see today; the comets and some asteroids may be leftover planetesimals

plasma | a hot ionized gas

plate tectonics | the motion of segments or plates of the outer layer of a planet over the underlying mantle

population I star | a star containing heavy elements; typically young and found in the disk

population II star | a star with very low abundance of heavy elements; found throughout the Galaxy

positron | particle with the same mass as an electron, but positively charged

precession of Earth | the slow, conical motion of Earth's axis of rotation caused principally by the gravitational pull of the Moon and Sun on Earth's equatorial bulge

prime focus | point in a telescope where the objective lens or primary mirror focuses the light

primitive rock | rock that has not experienced great heat or pressure and therefore remains representative of the original condensed materials from the solar nebula

prominence | a large, bright, gaseous feature that appears above the surface of the Sun and extends into the corona

proper motion | the angular change per year in the direction of a star as seen from the Sun

protein | a key biological molecule that provides the structure and function of the body's tissues and organs, and essentially carries out the chemical work of the cell

proton-proton chain | series of thermonuclear reactions by which nuclei of hydrogen are built up into nuclei of helium

protostar | a very young star still in the process of formation, before nuclear fusion begins

pulsar | a variable radio source of small physical size that emits very rapid radio pulses in very regular periods that range from fractions of a second to several seconds; now understood to be a rotating, magnetic neutron star that is energetic enough to produce a detectable beam of radiation and particles

pulsating variable star | a variable star that pulsates in size and luminosity

quasar | an object of very high redshift that looks like a star but is extragalactic and highly luminous; also called a quasi-stellar object, or QSO

radar | technique of transmitting radio waves to an object and then detecting the radiation that the object reflects back to the transmitter; used to measure the distance to, and motion of, a target object or to form images of it

radial velocity | motion toward or away from the observer; the component of relative velocity that lies in the line of sight

radiation | emission of energy as electromagnetic waves or photons also the transmitted energy itself

radio waves | all electromagnetic waves longer than microwaves, including radar waves and AM radio waves

radioactivity | process by which certain kinds of atomic nuclei decay naturally, with the spontaneous emission of subatomic particles and gamma rays

reddening (interstellar) | the reddening of starlight passing through interstellar dust because dust scatters blue light more effectively than red

redshift | when lines in the spectra are displaced toward longer wavelengths (toward the red end of the visible spectrum)

reflecting telescope | telescope in which the principal light collector is a concave mirror

refracting telescope | telescope in which the principal light collector is a lens or system of lenses

resolution | detail in an image; specifically, the smallest angular (or linear) features that can be distinguished

resonance | an orbital condition in which one object is subject to periodic gravitational perturbations by another, most commonly arising when two objects orbiting a third have periods of revolution that are simple multiples or fractions of each other

retrograde motion | the apparent westward motion of a planet on the celestial sphere or with respect to the stars

rift zone | in geology, a place where the crust is being torn apart by internal forces generally associated with the injection of new material from the mantle and with the slow separation of tectonic plates

right ascension | the coordinate for measuring the east-west positions of celestial bodies; the angle measured eastward along the celestial equator from the vernal equinox to the hour circle passing through a body

RNA | a molecule that aids in the flow of genetic information from DNA to proteins

RR Lyrae | one of a class of giant pulsating stars with periods shorter than 1 day, useful for finding distances

runaway greenhouse effect | the process by which the greenhouse effect, rather than remaining stable or being lessened through intervention, continues to grow at an increasing rate

satellite | an object that revolves around a planet

sedimentary rock | rock formed by the deposition and cementing of fine grains of material, such as pieces of igneous rock or the shells of living things

seeing | unsteadiness of Earth's atmosphere, which blurs telescopic images; good seeing means the atmosphere is steady

seismic wave | a vibration that travels through the interior of Earth or any other object; on Earth, these are generally caused by earthquakes

selection effect | the selection of sample data in a nonrandom way, causing the sample data to be unrepresentative of the entire data set

semimajor axis | half of the major axis of a conic section, such as an ellipse

SETI | the search for extraterrestrial intelligence; usually applied to searches for radio signals from other civilizations

sidereal day | Earth's rotation period as defined by the positions of the stars in the sky; the time between successive passages of the same star through the meridian

sidereal month | the period of the Moon's revolution about Earth measured with respect to the stars

singularity | the point of zero volume and infinite density to which any object that becomes a black hole must collapse, according to the theory of general relativity

solar day | Earth's rotation period as defined by the position of the Sun in the sky; the time between successive passages of the Sun through the meridian

solar flare | a sudden and temporary outburst of electromagnetic radiation from an extended region of the Sun's surface

solar month | the time interval in which the phases repeat—say, from full to full phase

solar nebula | the cloud of gas and dust from which the solar system formed

solar wind | a flow of hot, charged particles leaving the Sun

space velocity | the total (three-dimensional) speed and direction with which an object is moving through space relative to the Sun

spacetime | system of one time and three space coordinates, with respect to which the time and place of an event can be specified

spectral class | (or spectral type) the classification of stars according to their temperatures using the characteristics of their spectra; the types are O, B, A, F, G, K, and M with L, T, and Y added recently for cooler star-like objects that recent survey have revealed

spectrometer | an instrument for obtaining a spectrum; in astronomy, usually attached to a telescope to record the spectrum of a star, galaxy, or other astronomical object

spectroscopic binary | a binary star in which the components are not resolved but whose binary nature is indicated by periodic variations in radial velocity, indicating orbital motion

spiral arm | a spiral-shaped region, characterized by relatively dense interstellar material and young stars, that is observed in the disks of spiral galaxies

spiral galaxy | a flattened, rotating galaxy with pinwheel-like arms of interstellar material and young stars, winding out from its central bulge

starburst | a galaxy or merger of multiple galaxies that turns gas into stars much faster than usual

Stefan-Boltzmann law | a formula from which the rate at which a blackbody radiates energy can be computed; the total rate of energy emission from a unit area of a blackbody is proportional to the fourth power of its absolute temperature: $F = \sigma T^4$

stellar wind | the outflow of gas, sometimes at speeds as high as hundreds of kilometers per second, from a star

stony meteorite | a meteorite composed mostly of stony material, either primitive or differentiated

stony-iron meteorite | a type of differentiated meteorite that is a blend of nickel-iron and silicate materials

stratosphere | the layer of Earth's atmosphere above the troposphere and below the ionosphere

stromatolites | solid, layered rock formations that are thought to be the fossils of oxygen-producing photosynthetic bacteria in rocks that are 3.5 billion years old

subduction | the sideways and downward movement of the edge of a plate of Earth's crust into the mantle beneath another plate

sunspot | large, dark features seen on the surface of the Sun caused by increased magnetic activity

sunspot cycle | the semiregular 11-year period with which the frequency of sunspots fluctuates

super-Earth | a planet larger than Earth, generally between 1.4 and 2.8 times the size of our planet

supercluster | a large region of space (more than 100 million light-years across) where groups and clusters of galaxies are more concentrated; a cluster of clusters of galaxies

supermassive black hole | the object in the center of most large galaxies that is so massive and compact that light cannot escape from it; the Milky Way's supermassive black hole contains 4.6 millions of Suns' worth of mass

synchronous rotation | when a body (for example, the Moon) rotates at the same rate that it revolves around another body

synchrotron radiation | the radiation emitted by charged particles being accelerated in magnetic fields and moving at speeds near that of light

tail | (of a comet) a tail consisting of two parts: the dust tail is made of dust loosened by the sublimation of ice in a comet that is then pushed by photons from the Sun into a curved stream; the ion tail is a stream of ionized particles evaporated from a comet and then swept away from the Sun by the solar wind

tectonic | geological features that result from stresses and pressures in the crust of a planet; tectonic forces can lead to earthquakes and motion of the crust

telescope | instrument for collecting visible-light or other electromagnetic radiation

terrestrial planet | any of the planets Mercury, Venus, Earth, or Mars; sometimes the Moon is included in the list

thermophile | an organism that can tolerate high temperatures

tidal heating | the heating of a planet or moon's interior by variable tidal forces caused by changing gravitational pull from a nearby planet or moon

tide | alternate rising and falling of sea level caused by the difference in the strength of the Moon's gravitational pull on different parts of Earth

transit | when one astronomical object moves in front of another

transition region | the region in the Sun's atmosphere where the temperature rises very rapidly from the relatively low temperatures that characterize the chromosphere to the high temperatures of the corona

triple-alpha process | a nuclear reaction by which three helium nuclei are built up (fused) into one carbon nucleus

troposphere | the lowest level of Earth's atmosphere, where most weather takes place

type Ia supernova | a supernova formed by the explosion of a white dwarf in a binary system and reach a luminosity of about $4.5 \times 10^9 L_{\text{Sun}}$; can be used to determine distances to galaxies on a large scale

type II supernova | a stellar explosion produced at the endpoint of the evolution of stars whose mass exceeds roughly 10 times the mass of the Sun

ultraviolet | electromagnetic radiation of wavelengths 10 to 400 nanometers; shorter than the shortest visible wavelengths

velocity | the speed and direction a body is moving—for example, 44 kilometers per second toward the north galactic pole

visible light | electromagnetic radiation with wavelengths of roughly 400–700 nanometers; visible to the human eye

visual binary | a binary star in which the two components are telescopically resolved

void | a region between clusters and superclusters of galaxies that appears relatively empty of galaxies

volcano | a place where material from a planet's mantle erupts on its surface

wavelength | the distance from crest to crest or trough to trough in a wave

weakly interacting massive particles | weakly interacting massive particles are one of the candidates for the composition of dark matter

white dwarf | a low-mass star that has exhausted most or all of its nuclear fuel and has collapsed to a very small size; such a star is near its final state of life

Wien's law | formula that relates the temperature of a blackbody to the wavelength at which it emits the greatest intensity of radiation

X-rays | electromagnetic radiation with wavelengths between 0.01 nanometer and 20 nanometers; intermediate between those of ultraviolet radiation and gamma rays

zero-age main sequence | a line denoting the main sequence on the H–R diagram for a system of stars that have completed their contraction from interstellar matter and are now deriving all their energy from nuclear reactions, but whose chemical composition has not yet been altered substantially by nuclear reactions

zodiac | a belt around the sky about 18° wide centered on the ecliptic zenith the point on the celestial sphere opposite the direction of gravity; point directly above the observer year the period of revolution of Earth around the Sun