

“We orbit around the space!”

Glossary of P hysics Words

Absolute zero: The lowest possible temperature, at which substances contain no heat energy.

Acceleration: The rate at which the speed of an object is changing.

Anthropic principle: The idea that we see the universe the way it is because if it were different, we would not be here to observe it.

Antiparticle: Each type of matter particle has a corresponding antiparticle. When a particle collides with its antiparticle, both are annihilated, leaving only energy.

Atom: The basic unit of ordinary matter, made up of a tiny nucleus (consisting of protons and neutrons) surrounded by orbiting electrons.

Big bang: The singularity at the beginning of the universe.

Big crunch: The singularity at the end of the universe.

Black hole: A region of space-time from which nothing, not even light, can escape, because gravity is so strong.

Coordinates: Numbers that specify the position of a point in space and time.

Cosmological constant: A mathematical device used by Einstein to give space-time an inbuilt tendency to expand.

Cosmology: The study of the universe as a whole.

Dark matter: Matter in galaxies, clusters, and possibly between cluster that has not been observed directly but can be detected by its gravitational effect. As much as 90 percent of the mass of the universe may be in the form of dark matter.

Duality: A correspondence between apparently different theories that lead to the same physical results.

Einstein-Rosen Bridge: A thin tube of space-time linking two black holes.

Electric charge: A property of a particle by which it may repel (or attract) other particles that have a charge of similar (or opposite) sign.

Electromagnetic force: The force that arises between particles with electric charge; the second strongest of the four fundamental forces.

Electron: A particle with negative electric charge that orbits the nucleus of an atom.

Electroweak unification energy: The energy (around 100 GeV) above which the distinction between the electromagnetic force and the weak force disappears.

Elementary particle: A particle that, it is believed cannot be subdivided.

Event: A point in space-time, specified by its time and place.

Event horizon: The boundary of a black hole.

Field: Something that exists throughout space and time, as opposed to a particle that exists at only

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one point at a time.

Frequency: For a wave, the number of complete cycles per second.

Gamma rays: Electromagnetic rays of very short wavelength, produced in radioactive decay or by collisions of elementary particles.

General relativity: Einstein's theory based on the idea that the laws of science should be the same for all observers, no matter how they are moving. It explains the force of gravity in terms of the curvature of a four-dimensional space-time.

Geodesic: The shortest (or longest) path between two points.

Grand unified theory (GUT): A theory that unifies the electromagnetic, strong, and weak forces.

Light-second (light-year): The distance traveled by light in one second (year).

Magnetic field: The field responsible for magnetic forces, now incorporated along with the electric field into the electromagnetic field.

Mass: The quantity of matter in a body; its inertia, or resistance to acceleration.

Microwave background radiation: The radiation from the glowing of the hot early universe, now so greatly red-shifted that it appears not as light but as microwaves (radio waves with a wavelength of a few centimeters).

Neutrino: An extremely light particle that is affected only by the weak force and gravity.

Neutron: A particle very similar to the proton but without charge, which accounts for roughly half the particles in the nuclei of most atoms.

Neutron star: The cold star that sometimes remains after a supernova explosion, when the core of material at the center of a star collapses into a dense mass of neutrons.

No-boundary condition: The idea that the universe is finite but has no boundary.

Nuclear fusion: The process by which two nuclei collide and coalesce to form a single, heavier nucleus.

Nucleus: The central part of an atom, consisting only of protons and neutrons, held together by the strong force.

Particle accelerator: A machine that, using electromagnets, can accelerate moving charged particles, giving them more energy.

Phase: For a wave, the position in its cycle at a specified time: a measure of whether it is at a crest, a trough, or somewhere in between.

Photon: A quantum of light.

Planck's quantum principle: The idea that light (or any other classical waves) can be emitted or absorbed only in discrete quanta, whose energy is proportional to their frequency, and inversely proportional to their wavelength.

Positron: The (positively charged) antiparticle of the electron.

Proportional: "X is proportional to Y" means that when Y is multiplied by any number, so is X. "X is inversely proportional to Y" means that when Y is multiplied by any number, X is divided by that number.

Proton: A particle very similar to the neutron but positively charged, which accounts for roughly half the particles in the nuclei of most atoms.

Quantum mechanics: The theory developed from Planck's quantum principle and Heisenberg's uncertainty principle.

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Quark: A (charged) elementary particle that feels the strong force. Protons and neutrons are each composed of three quarks.

Radar (Radio detecting and ranging): A system using pulsed radio waves to detect the position of objects by measuring the time it takes a single pulse to reach the object and be reflected back.

Radioactivity: The spontaneous breakdown of one type of atomic nucleus into another.

Red shift: The reddening of light from a star that is moving away from us, due to the Doppler effect.

Singularity: A point in space-time at which the space-time curvature (or some other physical quantity) becomes infinite.

Space-time: The four-dimensional space whose points are events.

Spatial dimension: Any of the three dimensions—that is, any dimension except the time dimension.

Special relativity: Einstein’s theory based on the idea that the laws of science should be the same for all observers, no matter how they are moving, in the absence of gravitational phenomena.

Spectrum: The component frequencies that make up a wave. The visible part of the sun’s spectrum can be seen in a rainbow.

String theory: A theory of physics in which particles are described as waves on strings. Strings have length but no other dimension.

Strong force: The strongest of the four fundamental forces, with the shortest range of all. It holds the quarks together within protons and neutrons, and holds the protons and neutrons together to form atoms.

Uncertainty principle: The principle, formulated by Heisenberg, that it is not possible to be exactly sure of both the position and the velocity of a particle; the more accurately one is known, the less accurately the other can be known.

Virtual particle: In quantum mechanics, a particle that can never be directly detected, but whose existence does have measurable effects.

Wave/particle duality: The concept in quantum mechanics that there is no distinction between waves and particles; particles may sometimes behave like waves, and waves like particles.

Wavelength: For a wave, the distance between two adjacent troughs or two adjacent crests.

Weak force: The second weakest of the four fundamental forces, after gravity, with a very short range. It affects all matter particles, but not force-carrying particles.

Weight: The force exerted on a body by a gravitational field. It is proportional to, but not the same as, its mass.

Wormhole: A thin tube of space-time connecting distant regions of the universe. Wormholes might also link to parallel or baby universes and could provide the possibility of time travel.

