Glossary

angular momentum quantum number a quantum number associated with the angular momentum of electrons

atom basic unit of matter, which consists of a central, positively charged nucleus surrounded by negatively charged electrons

atomic de-excitation process by which an atom transfers from an excited electronic state back to the ground state electronic configuration; often occurs by emission of a photon

atomic excitation a state in which an atom or ion acquires the necessary energy to promote one or more of its electrons to electronic states higher in energy than their ground state

atomic number the number of protons in the nucleus of an atom

Bohr radius the mean radius of the orbit of an electron around the nucleus of a hydrogen atom in its ground state

Brownian motion the continuous random movement of particles of matter suspended in a liquid or gas

cathode-ray tube a vacuum tube containing a source of electrons and a screen to view images

double-slit interference an experiment in which waves or particles from a single source impinge upon two slits so that the resulting interference pattern may be observed

energies of hydrogen-like atoms Bohr formula for energies of electron states in hydrogen-like atoms: $E_n = -\frac{Z^2}{n^2}E_0 (n = 1,\ 2,\ 3,\ ...)$

energy-level diagram a diagram used to analyze the energy level of electrons in the orbits of an atom

fine structure the splitting of spectral lines of the hydrogen spectrum when the spectral lines are examined at very high resolution

fluorescence any process in which an atom or molecule, excited by a photon of a given energy, de-excites by emission of a lower-energy photon

hologram means *entire picture* (from the Greek word *holo*, as in holistic), because the image produced is three dimensional

holography the process of producing holograms

hydrogen spectrum wavelengths the wavelengths of visible light from hydrogen; can be calculated by $\frac{1}{\lambda} = R\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

hydrogen-like atom any atom with only a single electron

intrinsic magnetic field the magnetic field generated due to the intrinsic spin of electrons

intrinsic spin the internal or intrinsic angular momentum of electrons

laser acronym for light amplification by stimulated emission of radiation

magnitude of the intrinsic (internal) spin angular momentum given by $S = \sqrt{s(s+1)}\frac{h}{2\pi}$

metastable a state whose lifetime is an order of magnitude longer than the most short-lived states

orbital angular momentum an angular momentum that corresponds to the quantum analog of classical angular momentum

orbital magnetic field the magnetic field generated due to the orbital motion of electrons

Pauli exclusion principle a principle that states that no two electrons can have the same set of quantum numbers; that is, no two electrons can be in the same state

phosphorescence the de-excitation of a metastable state

planetary model of the atom the most familiar model or illustration of the structure of the atom

population inversion the condition in which the majority of atoms in a sample are in a metastable state

quantum numbers the values of quantized entities, such as energy and angular momentum

Rydberg constant a physical constant related to the atomic spectra with an established value of 1.097×10^7 m^{-1}

shell a probability cloud for electrons that has a single principal quantum number

space quantization the fact that the orbital angular momentum can have only certain directions

spin projection quantum number quantum number that can be used to calculate the intrinsic electron angular momentum along the z-axis

spin quantum number the quantum number that parameterizes the intrinsic angular momentum (or spin angular momentum, or simply spin) of a given particle

stimulated emission emission by atom or molecule in which an excited state is stimulated to decay, most readily caused by a photon of the same energy that is necessary to excite the state

subshell the probability cloud for electrons that has a single angular momentum quantum number l

x rays a form of electromagnetic radiation

x-ray diffraction a technique that provides the detailed information about crystallographic structure of natural and manufactured materials

z-component of spin angular momentum component of intrinsic electron spin along the z-axis

z-component of the angular momentum component of orbital angular momentum of electron along the z-axis

Zeeman effect the effect of external magnetic fields on spectral lines