Radiation

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In physics, radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation. Waves of a massive medium itself, such as water waves or sound waves, are usually not considered to be forms of "radiation" in this sense. By contrast, gravitational waves, which are waves of space-time itself, qualify as a type of radiation.

Two energies of radiation are commonly differentiated by the way they interact with normal chemical matter: **ionizing** and **non-ionizing radiation**. The word radiation is often used in reference to ionizing radiation (i.e., radiation having sufficient energy to ionize an atom), but the term radiation may correctly also refer to non-ionizing radiation (e.g., radio waves, heat or visible light). The particles or waves radiate (i.e., travel outward in all directions) from a source. This aspect leads to a system of measurements and physical units that are applicable to all types of radiation. Because radiation radiates through space and its energy is conserved in vacuum, the power of all types of radiation follows an inverse-square law of power with regard to distance from its source.

Both ionizing and non-ionizing radiation can be harmful to organisms and can result in changes to the natural environment. In general, however, ionizing radiation is far more harmful to living organisms per unit of deposited energy than non-ionizing radiation, since the ions that are produced by ionizing radiation, even at low radiation powers, have the potential to cause DNA damage. By contrast, most non-ionizing radiation is harmful to organisms only in proportion to the thermal deposited energy, and is conventionally considered harmless at low powers which do not produce significant temperature rise. Ultraviolet (UV) radiation in some aspects occupies a middle ground, in having some features of both ionizing and non-ionizing radiation. Although nearly all of the UV spectrum of radiation is non-ionizing, at the same time UV radiation does far more damage to many molecules in biological systems than is accounted for by heating effects (an example is sunburn). These properties derive from UV power to alter chemical bonds, even without having quite enough energy to ionize atoms.

The question of harm to biological systems due to low-power ionizing and non-ionization radiation is not settled. Controversy continues about possible non-heating effects of low-power non-ionizing radiation, such as non-heating microwave and radio wave exposure. Non-ionizing radiation is usually considered to have a safe lower limit; especially as thermal radiation is unavoidable and ubiquitous. By contrast, ionizing radiation is conventionally considered to have no completely safe lower limit, although at some energy levels, new exposures do not add appreciably to background radiation. The evidence that small amounts of some types of ionizing radiation might confer a net health benefit in some situations is called radiation hormesis.

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