Infrared waves

Infrared waves have a frequency about 100 times greater than radio waves. They are invisible waves that are emitted by hot objects and, therefore, are used when temperature is the crucial variable. So infrared radiation (IR) is used in imaging or detecting warm objects when visibility is not possible, such as identifying bodies using night vision and tracking rocket engines or missiles. Since IR does not penetrate walls, it can also be used for remote controls and for communication between computer peripherals without interfering with neighbours' devices. It is also used as a heating source in its own right: for example, for removing ice from the wings of aircraft; for treatment of pain, injuries and arthritis; for cooking; and for industrial applications such as plastic welding and print drying. Care needs to be taken when using IR, especially since the radiation is invisible, so IR-proof protective eyewear needs to be worn.

Ultraviolet waves

Ultraviolet (UV) waves have a wavelength shorter than that of visible light, but longer than X-rays. They are present in sunlight but are invisible to the eye. UV waves are produced by extremely hot objects and by glowing gases. For example, fluorescent light tubes use glowing gases to produce light. One claimed benefit of UV waves is that they produce vitamin D in our skin—vitamin D deficiency can cause problems with bones and even some premature deaths due to cancers. However, too much exposure can cause be harmful and cause skin cancer. Another problem of exposure to UV radiation is possible damage to the eyes without protective eyewear. UV radiation also breaks down polymers use in consumer products such as paints. There are many positive uses of UV radiation. For example, it can be used to maintain hygiene because it attracts and then kills germ-carrying insects, and it is used as a UV watermark in credit cards and passports to make them more secure. Because of ultraviolet light, some insects, such as bees, are able to detect nectar in flowers while birds, for example, can detect sex-dependent markings on other birds' plumage.

X-rays

X-rays are the second-shortest rays of the electromagnetic spectrum. The discovery by Röntgen that X-rays can identify bone structures has led to their use for medical imaging. They are commonly used to detect damage to the skeletal system but are also used for identifying soft-tissue damage. Radiotherapy, a process of applying high levels of radiation, uses X-rays to treat certain types of cancers and other malignant diseases because diseased cells die when X-rays are focused upon them. Other uses of X-rays include: identifying the structure of crystals; examining paintings to detect and analyse any hidden alterations ; and the increasingly common use of scanning luggage at airports for security purposes. Improper use of X-rays may result in healthy cells being destroyed or the DNA within the nucleus being damaged so that the cells are more likely to become cancer cells.

Gamma rays

Gamma rays are the shortest rays in the spectrum. They are emitted from sub-atomic particle interactions of radioactive materials. Because their wavelength is so short, they can cause significant damage to living organisms, such as bacteria, so are used to remove decay-causing bacteria from foodstuffs and to sterilise medical equipment. Further applications in the medical field include cancer and tumour detection and treatment. Because gamma rays can easily penetrate dense metals, they are used to take X-ray-type photographs of metals and to scan large structures such as shipping containers. Although gamma rays' potential for changing molecular structure is positively used when altering the properties of semi-precious stones (eg white topaz can be changed to blue topaz), large amounts of gamma rays can seriously harm the cells in our bodies because, like X-rays, they can destroy the DNA within the cell nucleus.