X-ray radiation - physical nature, spectrum area

Physical essence

X-rays are electromagnetic waves with high energy and wavelenghts in the range of 10^{-8} to $10^{-11/-12}$ m, lying between UV a γ radiation. t is non-nuclear radiation. Energy transfer occurs discontinuously in electromagnetic energy quanta. It belongs to ionizing radiation. It is creatd in x-rays by the interaction of electrons flying from the cathode with the atoms of the anode material. It is widely used in analytic chemistry, crystallography and above all in medical diagnostics, where many physical properties of X-rays are used. There are two types of X-rays - so-called bremsstrahlung X-rays and characteristic X-rays.

History

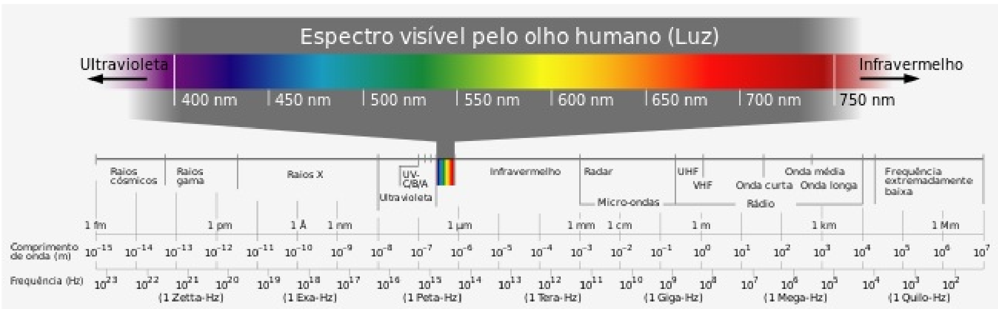
German scientist **Wilhelm Conrad Röntgen** is considered the discoverer of X-rays. Although the mathematical description of this radiation was translated by Hermann von Helmholtz some time earlier. Röntgen himself called this newly discovered radiation X-rays, as it was a completely unknown matter. This name is still used today in some languages (e.g. English), other languages such as German, Danish or Czech named this radiation after its discoverer. In 1901, Röntgen received the first ever Nobel Prize in Physics for his discoveries..

But X-rays also attracted the attention of doctors because of their ability to "see into a person". Already in 1896, a book was published on the methods of diagnosing tuberculosis with the help of X-rays. In the course of time, broad possibilities of use in therapy also began to be discovered - in 1897, skin cancer was treated with the help of X-rays in Vienna. After that, many scientists of the 20th century continued to investigate X-rays.

In the 1950s, the X-ray microscope was invented.

Properties

1) **Rectilinear propagation from the source** – X-rays propagate into space in all directions and its intensity decreases with the square of the distance.



Electromagnetic spectrum

2) **Penetration through matter** – Depends on the properties of the absorbing object and the energy of the radiation. The energy and thus the penetration increases with decreasing wavelenght of the radiation.

3) **Differentiated absorption** – Differentiated absorption of different tissues of the body is also necessary for the creation of an image, which increases with the thickness of the layer, density or higher proton number of the element of the irradiated substance. These differences determine the saturation of shadows and thus the possibility of distinguishing individual structures. The bones show a white shadow due to the high content of calcium and phosphorus, on the other hand, the lungs appear transparent due to the high air content and low density.

4) **Luminescent effect** – Visible radiation can be produced when X-rays hit certain materials. An image is created that can be observed directly during the enlightenment.

5) **Photochemical effect** – The ability to create a hidden image in the sensitive layer of the film.

6) **Scattering of radiation** – For example Compton scattering is applied (the deflected beam continues in a different direction with reduced energy). Dispersion reduces the contrast of the display.

7) **Ionization effect** – The process by which an electrically neutral atom becomes an ion can cause serious damage to the irradiated tissue.

Use

X-rays are used in medicine to display details of bones and teeth (sciagraphy) or to examine soft tissue (densitography, sciagraphy, tomography). Diagnostics based on X-ray examinations is dealt with by a specialized medical field called radiology.

Links

Related articles

- Ionizing radiation
- Visible radiation
- Electromagnetic radiation
- Computed tomography

References

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- VANĚRKA, Michael – VYHNÁNEK, Luboš. *Wilhelm C. Röntgen.* 1. edition. Praha : Horizont, 1989. ISBN 80-7012-024-X.

X-ray of the knee

X-ray machine at a Chiropractic Office