Electromagnetic spectrum uses pdf

Full range of frequency of electromagractic radiation Grade Freq-uency wave-length energy per photon Ionizingradiation γ Gama Ray 300 EHz 1 pm 1.24 MeV 30 EHz 10 pm 124 keV HX HX Hard X-ray 3 EHz 100 pm 12.4 keV SX X-ray 300 PHz 1 nm 1.24 keV 30 PHz 10 nm 124 eV EV Extremeultravolet 3 PHz 100 nm 12.4eV NUV Nearultravolet , visible 300 THz 1 μm 1.24 eV NIR near infrared 30 THz 10 μm 124 meV MIR Mid Infrared 3 THz 100 μm 12.4 meV FIR Far Infrared 300 GHz 1 mm 1.24 meV Micro-vagsandodiowaves EHF Incredibly Thrive 30 GHz 1 cm 124 μeV SHF Super highfrequency 3 GHz 1 dm 12.4 μeV UHF Ultrafrequency 300 MHz 1 m1.24 μeV VHF Very Thrive 30 MHz 10 m 124 neV HF Highfrequency 3 MHz 100m 12.4m neV MF Mediumfrequency 300 kHz 1 km 1.24v LF Lowfrequency 30 kHz 10 km 124 peV VLF Very lowfrequency 3 kHz 100 km 12.4 peV ULF Ultra Frequency 300 Hz 1000 km 1.24 peV SLF Super lowfrequency 30 H 10 km 124 fev ELF Incredibly refresh 3 Hz 100000 km 12.4 fev Source: File: light spectrum.svg[1] [1] 2][3] The electromagnoetic spectrum is the range of frequency (spectrum) of electromagnetic radiation and their respective wavelenakes and photon energy. The electromagnetic spectrum covers electromaganatic waves and frequency from below a hertz above 1025 erect, corresponding to wavelenched from thousands of kilometers down to a fraction of the size of a core of homicides. This frequency series is divided into separated music groups, and the electromagnitive waves of each frequency band are called by different names; The start of low frequency (long waves) at the end of the following spectrum is: radio waves, micro-waves, infrared, visible light, ultravoylet, X-ray, and gamma rays in the high-frequency frequency (short length) ends. The electromaganatic waves in each of these groups have different characteristics, such as how they are generated, how to interact with issues, and their practical applications. The limit for long wavelengths is the size of the universe itself, while it is thought that the short wavelength limit is in the vicinity of the Planck length. [4] Gamma rays, X-ray, and high ultravoylet are classified as radiation illustrations as photographs have enough energy to ionize atoms, resulting in chemical reactions. In most of the high frequency bands, a technique called spectroscopy can be used physically separate waves at different frequency, producing a spectrum showing the constituent frequency. Spectroscopy is used to study their interactions in electromagnetic waves and problems. [5] Other uses of technologicals are described under electromagnetic radiation. History and discovery See also: Stories of electromayetism, History of Radio, History of Electrical Engineering, and History of Scanning For most of history, visible light was the only part known to the electromagrmagre spectrum. The ancient Greek recognized that light traveled through straight lines and studied some of its properties, including reflection and The study of light continues, and during the 16th centuries and 17th conflict theory conflicts as light as either a wave or a particle. The first discovery of electromagoveric radiation other than visible light occurs in 1800, when William Herschel discovers infrared radiation. He studied the temperature of different colors by moving a thermometer into split light by a premium. He noticed that the highest temperature was beyond melting. It was organized that this temperature change was due to colorful rails, a kind of light rails that could not be seen. The next year, Johann Ritter, who works at the other end of the spectrum, noticed what he called chemical rays (invisible light rays that provoked certain chemical reactions). These behave like the visible violence of light rays, but they were far beyond them in the spectrum. [8] And they later renamed the radiation of retrievotics. Electromagnetic radiation was first linked to electromagneticism in 1845, when Michael Faraday noted that polarization of light traveled through a transparent material responded to a magnetic field (see Faraday Effect). During the 1860s James Maxwell developed four partial equations for the electromagnetic field. Two of those equations predict the possibility and surge behavior in the field. Analyzing the speed of these theoretical waves, Maxwell realized that to be traveling at a speed that was on the speed known in light. This coincidence starts to Maxwell's led values making inference that light itself is a kind of electromagnate wave. The Maxwell equation had anticipated an infinite frequency of electromaganatic waves, all traveling at the speed of light. This was the first indication of the existence of the entire electromagromagnetic spectrum. The maxwell evidence surge included waves of low frequency compared to infrared, which in theory could be created by affordable charges in an ordinary electric circuit of a certain type. Try to prove the Maxwell equation and sensors such as frequency of electromagovernate radiation, in 1886 physics Heinrich Hertz built a generous device and detected so-called radio waves. Hertz found waves and was able to infer (by measuring the lengths and multiplying it by the frequency) that they travel at the speed of light. Hertz also demonstrated that the new radiation could be both reflected and refracted by dielectric media dielectrics, in the same way as light. For example, Hertz could concentrate the waves using a lens made of wood resin. In a later experiment, Hertz similarly produced and measured the properties of microwaves. These types of new waves were ready the way for inventions such as telegraph Wireless and the radio. In 1895 Wilhelm Röntgen noticed a new type of radiation emitted during an experiment with an evacuating tube suggested at a high voltage. He called these radiation x-ray and found that they could travel across parts of the human body but reflect or stop by renser problems such as bones. Before long, many uses were found to be in the field of medicine. The last portion of the electromagnist spectrum was full of with the discovery of gamma rays. In 1900 Paul Villard studied the radioactive broadcasts of radio and particles, but with the power they were far more penetrating last night. However, in 1910, British physicist William Henry Bragg demonstrated that the Gamma rays are electromagnetic radiation, by particles, and in 1914, Ernest Rutherford (who was called the gamma rays in 1903 when he realized that they were basically different from packed alpha and particle beta) and Edward Andrade measured the wavelenail, and found that Gamma rays were similar to X-ray, but with shorter wavelenails and higher frequency. Electromagnetic waves are typically described by any of the following three physical properties: the frequency λ, the surge, or photon energy E. Frequency observed in astronomy range from 2.4×1023 Hz (1 GeV gamma rays) down to the local plasma frequency of medium to interstellile ionized medium (~1Hz kHz). Waveleng is inversely proportional to the wave frequency,[5] so gamma rays have very short wavelengths which are fractions of the size of atoms, whereas wave length on the opposite end of the spectrum may be as long as the universe. Photon Energy is directly proportional to wave frequency, so photon rails gamma have elevated energy (around a billion voltage electronics), while photon radio waves have very low energy (around a femtoelectronl). These relationships are illustrated by the following derived: f = c λ , or f = E , or E = h λ , { \ show display f = {\frak{c}{c}\lambda}}, \quad {\text{or}}\quad={\frac{E}}},\quad{text{or}(quad ={frac{hc}{lambda},}location:c=29979245 m/s is the speed of light in a vacuum h= 6.62607015×10−34 J· s = 4.1356733(10)×10−15 eV·s is the planck constant. [9] Whenever electromagnate waves exist in a medium and problem, the length is decreased. Wavelengths of electromagnerial radiation, regardless of the means they are traveling in, are usually cited in terms of the vacuum length, although this is not always explicitly stated. Generally, electromagractic radiation is sorted by wavelengths of radio waves, microwaves, infrared, visible lights, ultraviolet, X-ray and gamma rays. The behavior of EM radiation relies on its pavement. When EM radiation reacts with single atoms and molecules, its behavior also depends on the amount of energy per amount (photon) it carries. Spectroskopy can detect a wider region of the EM spectrum than the visible wave range of 400 nm 700 nm in a vacuum. A common laboratory spectroscopy can detect plugins from 2 nm to 2500 nm. [summons needed] Detailed information about the physical properties of object, gas, or even star get to this device type. Spectroscopes are widely used in astrophysic. For example, many hydrogen atoms emit a radio wave photographn that has a wavelench at 21.12cm. Also, the frequency of 30 Hz and below can be produced by and is important in the study of certain certain nebulae[10] and frequency as high as 2.9×1027 Hz have been detected from astrophysic sources. [11] The electromagromagical spectrum Region A diagram of the electromagnetic spectrum, showing various properties across frequency range and wavelenake electromagre radiation types are widely classified in these classes (regions, Strips or types): [5] Gama radiation X-ray radiation Ultravolet visible light infrared radiation Microwave thin radiation wave goes in the increased order of the wave order, which is the characteristic of that type of radiation. [5] There is no limit precisely defined between the groups of the electromagnagically spectrum; instead they flourish with each other like the bands in a rainbow (which is sub-spectrum of visible light). The radiation of each frequency and wavelench (or in each band) has a mixture of properties of the two regions in the spectator that bind it. For example, red light looks like infrared radiation in that it can excite and add energy to some chemical link and indeed must do what power the chemical mechanisms that are responsible for fotosynthesis and the work of the visual system. The distinction between X-ray and gamma rays is partly based on source: the photographs are generated from nuclear decomposition or other nuclear and subnuclear/particle processes are still theme gamma rays, whereas X-rays are generated by electronic transitions involving highly drastic electronic atomic rays. [12] [13] [14] In general, nuclear transitions are much more drastic than electronic transitions, so gamma-rays are more drastic than X-ray, but exceptions exist. By analogous to electronic transitions, transitioning atoms are also said to produce X-ray, though their energy can exceed 6 megaelectronlts (0.96pJ), [15] whereas there are many (77 known to be less than 10 keV (1.6fJ)) low-energy nuclear transitions (e.g., 7.6eV's (1.22)) nuclear transition to thorium-229), and, despite being a million-fold less drastic than some muonic X-ray, the uniformed photographs are still called gamma rays due to their nuclear origins. [16] The convention that EM radiation which is known from the nucleus, is still called radiation gamma is the only convention that is universally respected, however. Many astronomical gamma ray sources (such as gamma ray clash) are known to be too drastic (at both intensity and length) to be of nuclear origin. Quite often, in high energy physics and in medical radiotherapy, very high EMR energy (in the region >10 MeV) – which is at higher energy than any nuclear gamma rails — is not called X-ray or gamma-ray, but rather by the generic term of high energy photon. the spectrum region where a particular observing electromagromagical radiation collapsed, frame-dependent reference (due to changes in Doppler for light), so EM radiation that an observer would say is in a region of the spectrum could appear to an observer moving at a substantial fraction of the speed of light with respect to the first to be in another part of the spectrum. For example, consider the microve cosmic background. It was produced when problems with radiation uncovered, by de-the excitement of hydrogen atoms in the state were. These photographs came from transition to Lyman series, placing them in the ultravoylet (UV) part of the electromagnate spectrum. Now this radiation has been undergoing enough red cosmeological changes to put it in the micro-spectrum region for observers moving slowly (compared to the speed of light) with respect to the cosmos. Rational electromagnetic radiation names react with problems in different ways across the spectrum. These kinds of interactions are so different that historically different names have been applied in different parts of the spectrum, even though these were different types of radiation. So although these different types of electromagnetic radiation form a quantitatively ongoing spectrum of frequency and wavelenax, the spectrum remains divided for practical purposes related to these qualitative interaction differences. Electromagnetic radiation interaction with Region issues in the Main Spectrum interactions and Radio Collective Oscilation in company charges of essential materials (plasma oscilation). An example would be oscilators to travel to the electrons in an antenna. Microwave from distant plasma occupation, molecular rotation near molecular hum, plasma oscillation (in metal only) Visible molecular electronic stimulation (including molecule pigments found in the human retina), plasma oscillation (of metal only) Ultraviolet Excitement in electronic atomic valens, including the ejection of electrons (fotoelectric effects) X-ray Stimulation and Ejection of Atomic Core Electrons , Compton spreads (for atomic numbers) gamma rails drastic ejection of core electrons in heavy components, Compton spreads (for all atomic numbers), excitement of atomic nuclei, including dissociation of nuclei high-energy radius game creation of pairs of particle-antipathic nuclei. In very high energy a single photon can create a high-energy particle shower and antipathic about interactions and questions. Radio surge radio main item type: radio frequency, radio spectator, and radio waves are emitted and received by antennas, composed of conductors such as reasonable red metal. In artificial generation of radio waves, an electronic device called a transmitter generates an AC Electric current that applies to an antenna. The okile electrons in the antenna generate electrical oscillations and magnetic fields that are radioed of the antenna as radio waves. At reception of radio waves, osilten electric and magnetic fields in a couple of radio waves of electrons into an antenna, push them back and forth, creating oscilation currents that apply to a radio receiver. Earth's atmosphere is mostly transparent in radio waves, except for the packed particle layer of the ionosphere that can reflect certain frequency. Radio waves are very widely used to transmit information via distance to radio communication systems such as radio broadcasting, TV, two way radio, mobile phone, communication satellites, and wireless networks. In a radio communication system, a modular radio frequency and an information-borne signal to a transmitter do not vary either amplitude, frequency or phase, and apply to an antenna. The radio waves bring information across space to a receiver, where they are received by an antenna and the information is extracted by the receiver's demodulation. Radio waves are also being used for navigation in systems such as global positioning systems (GPS) and beacon navigation, and locate distant objects in radiolocation and radar. They are also used for remote control, and for industrial heating. The use of the radio spectrum is strictly regulated by government, coordinated by a body called the International Telecommunications Union (ITU) that assigns the frequency of different users for different users. Main article Microwaves: Microwaves Fleet of Earth's atmospheric hopassity at various hemorrhages of electromagnate radiation. This is the surface-to-space affluentity, this the atmosphere is transparent in long radio transmission of the troposphere, not opact as shown on the board. Microwaves are radio waves at short lengths, from about 10 centimeters in a millimeter, to SHF and EHF frequency codes. Microwave energy produced with klystron and mayetra tubes, and solid state devices such as weapons and iMPATT diobcotes. Although they are emitted and absorbed by short antennas, they are also absorbed by polar molecules, custom vibrational and rotational modes, resulting in essential heating. Unlike higher frequency waves such as infrared and light that absorb mainly surface, microwaves can be penetration into materials and deposite their energy below the surface. This effect is the use of heat feed in micro-opa oven oven, and for industrial heating and medical diathermy. Microwaves are the main lengths used in radar, and are used for satellite communication, and wireless networking technologies such as Wi-Fi. The copper cbles (transmission lines) which are used to bring lower frequency radio waves to antennas have excessive power losses in micro-severity frequency, and metal pipes called waves they used to carry them. Although the low end of the atmosphere is mostly transparent, the upper end of the microwave absorption by atmospheric practical gas limits the distance of a few kilometers. Terahertz radiation or target-millimeter radiation is a region of the spectrum from about 100 GHz to 30 terahertz (THz) between micro-infrared and far right that can be considered part of either strips. Until recently, the fix has rarely studied and some sources existed for micro-snail energy in the so-called terahertz gap, but applications such as imaging and communication are now displayed. Scientists are also looking to implement terahertz technology in the armed forces, where high-frequency waves could be directed to enemy troops encompassing electronic equipment. [17] Terahertz radiation strongly absorbed by atmospheric gas, making this frequency range useless for long distance communication. Infrared Main Radiation Article: Infrared infrared parts of the electromagnetic spectrum cover the range from approximately 300 GHz to 400 THz (1 mm - 750 nm). It can be divided into three parts: [5] far-infrared, from 300 GHz to 30 THz (1 mm - 10 μm). The lower part of this spectrum can also be called micro-or terahertz waves. This radiation is typically absorbed by so-called rotational modes of gas-phase molecules, by molecular molecules in liquids, and by phons of solids. The water in the Earth's atmosphere is absorbed so strongly in this range that it renders the atmosphere of ophthalmrace effect. However, there are certain wave ranges (windows) in the scanning range that allow partial transmission, and can be used for astronomy. The wave range from about 200 μm up to one mm mm is commonly referred to as sub-millimeter of astronomers to astronomers, reserve well beyond infrared for wavelenails below 200 μm. Mid-infrared, from 30 to 120 THz (10–2.5 μm). Hot objects (black-body radiators) can radio strongly in this range, and human skin at normal body temperature radiators strongly at the lower end of this region. This radiation is absorbed by molecular hum, where atoms are different in a vibrant molecule around their poised position. This range is sometimes called the fingerprint region, since the mid-infrared spectrum spectrum of a compound is very specific for this compound. Near-infrared, from 120 to 400 THz (2,500–750 nm). The physical process that is relevant to this fix is similar to those for visible light. The high frequency of this region can be detected directly by some kind of photography film, and by many kinds of strong image sensors for infrared photography and videography. Visible Items Main: Spectrum visible above infrared at visible light frequency. The sun emitted its power shafts in the visible region, although integrating the spectrum of entire emission power throughout wavelench shows that the Sun emitted slightly more infrared than visible light. [18] By definition, visible light is part of the EM spectrum of the human eye is the most sensitive. Visible light (and near-infrared light) is typically absorbed and emitted by electrons in molecules and which moves from one level of energy to another. This action allows the chemical mechanisms that undergo human vision and plant photosynthesis. The light that arouses the human visual system is a very small portion of the electromagnetic spectrum. A rainbow shows the optical (visible) part of the electromagromagical spectrum; Infrared (if it could be seen) would be sitting just beyond the red side of the rainbow and ultraviolet appeared just beyond the end of violence. Electromagnogic radiation with a wavelex between 380 nm and 760 nm (400–790 terahertz) is detected by the human eye and known as visible light. Other lips, especially near infrared (longer than 760 nm) and ultraviolet (shorter than 380 nm) are also sometimes referred to as light, especially when the human visibility is not relevant. White light is a combination of light of different wavelecks of the visible spectrum. Passing white light in a prism to split it up in the several colors of light observed in the visible spectrum between 400 nm and 780 nm. If radiation with a frequency in the visible region of the EM spectrum reflects in an object, say, a bowl of fruit, and then hits the eyes, this results in visual perception of the scene. The brain's visual system processes the multitude of frequency reflected in different shade and guesses, and in this insignificantly-understood psychosic phenomenon, most people see a bowl of fruit. At most pavements, however, information carried by electromagnically radiation is not directly detected by human sense. Natural sources produce EM radiation across the spectrum, and technology can also manipulate a broad range of lengths. Optical transmitting light which, although not necessarily in the visible part of the spectrum (it is usually infrared), can carry information. The module is similar to that used with radio waves. Main ultraviolet radiation article: Ultraviolet the amount of penetration at UV relative to the Altitude of the Earth's Next ozone at ultraviolet frequency (UV). The length of UV rails is shorter than the violent end of the visible spectrum but longer than the X-ray radio. UV is the long pavement radiation that is photon drastic enough to ionize atoms, separate electrons from them, and thus cause chemical reactions. Shorter UV lengths and the radiation are shorter than it (X-ray and gamma rays) are called ional radiation, and exposure to them can damage living tissue, making them a health hazard. UV can also cause many substances to flow with visible light; this is called fluorescence. In the middle range of UV, UV rails can't ionize but can break chemical links, making molecules very reactive. Sunburn, for example, is caused by the disrupted effects of mid-range radiation UV on skin cells, which is the main cause of skin cancer. UV rays in the middle range can irreparably damage the complex DNA molecules in cells to produce timine dimers it's a very buster mutagen. The sun emitted significant UV radiation (about 10% of its total power), including very short UV loads that could potentially destroy most lives on Soil (sea water would provide some protection for life there). However, most of the sun's damage to UV wavelenails are absorbed by the atmosphere before reaching the surface. The higher energy (short wavelena) ranges from UV (named vacuum to UV) are absorbed by nitrogen and, in length, by simple oxygen in the air. Most of the UV in the mid-range of energy is blocked by the ozone layer, which absorbs strongly in the vital 200-315 nm range, the lower energy part of which is too long for ordinary dioxygen in the absorbed air. That leaves less than 3% of sunlight at sea levels in UV, and all this remains in the lowest energy. The rest is UV-A, along with some UV-B. The lower energy range of UV between 315 nm and visible light (called UV-A) is not blocked well by the atmosphere but does not cause the sun and does less biological damage. However, it is not harmless and creates radical oxygen, mutations and skin damage. X-ray main article: X-ray after UV comes X-ray, which, like the upper ranges of UV are also ionized. However, due to their higher energy, X-ray can also communicate with questions by means of the Compton effect. Hard X-ray has shorter lengths than X-ray X-ray and as can be passed through many substances with little absorption, they can be used to 'see in' objects with 'thickness' less than that equivalent to a few metres of water. A remarkable use is the diagnosis of X-ray imagined in medicine (a process known as X-ray). X-rays are useful as depths of physics-high energy. In astronomy, disk are acretion around black stars and also black uniformed X-ray, enabling studies of these phenomena. X-rays are also emitted by korona stellar and are strongly emitted by some kind of nebulae. However, the X-ray telescope must lay out The Earth's atmosphere to see astronomical X-ray, since the great depth of the Earth's atmosphere is opaque to X-ray (with density of 1000 g/cm2), equivalent to 10 meters thickness of water. [19] This is a sufficient amount to block almost all astronomical X-ray (and also astronomical gamma gamma rays –see below). Gamma Ray Main article: Gamma Ray after hard X-ray comes Gamma ray, discovered by Paul Ulrich Villard in 1900. These are the most drastic photons, with no defined limitations lower in their length. In astronomers there are intense value for studying high-energy objects or regions, however as with this X-ray can only be done with telescope outside earth's atmosphere. The Gamma Ray is being used experimentally by physicists for their penetrating capabilities and produced by a number of radioactives. They are used for radiotherapy in foods and pills for sterilization, and in medications they periodically use radiation cancer therapy. [20] Most often, the the rays were used to diagnose imagined naked medications, an example of being PET analysis. The wave of gamma rays can be measured with high accuracy of the effects of Compton spread. See also Electronic Port Telecommunication Door Bandplan Cosmic Ray Digital Digital After Transition Digital TELEVISION Transition Electrofagraphy Infrared Window Ion Radiation List To International Standard Optical Window Ozontal Coating Radiation Energy Radiation Window Spectroscopy VUrn W And Reference

^ What is Light? Archived December 5, 2013, at the Wayback Machine – UC Davis Lecture Conference ^ Elert, Glenn. The Electromagnetic Spectrum, the Physics Hypertextbook. Hypertextbook.com. Retrieve 2010-10-16. ^ The definition of frequency strips on. Vlf.it. Retrieved 2010-10-16. ^ Bakshi, A.A.; Dieu, A. P. (2009). Basic Electronic Engineering. Technical publications. pp. 8–10. Isbn 978-81-8431-580-6. ^ a c c d Mehta, Akul. Introduction to the Electromagnetic Spectrum and Spectroscopy. Pharmaxchange.info. Retrieve 2011-11-08. Ù Haitel, Superman (2014-05-15). Origins and Grand Finale: How the Bible and Science Relate to the Origins of Everything, Abuse of Political Authority, and Prediction End Times. universe. ISBN 9781491732571. ^ Herschel Discovers Infrared Light. Cool classroom activity cosmos. Archived from the original on 2012-02-25. Retrieved 4 March 2013. It led the sunlight into a glass prism to create a spectrum [...] and then measured the temperature of each color. [...] He found that the temperatures of color are increased from the violence to the red part of the spectrum. [...] Herschel decided to measure the temperature just beyond the red from the spectrum of a region where no sunlight was visible. To his surprise, he found that this region had the highest temperature of all. ^ Davidson, Michael W. Johann Wilhelm Ritter (1776–1810). Florida State University. Retrieved March 5, 2013. Ritter [...] hypothesis that there must also be invisible radiation beyond the violent end of the pageant and experience begins to confirm his speculation. He began working with silver chloride, a substance decomposed by light, measuring the speed at which different colors of his broken light. [...] Ritter [...] demonstrated that the fastest rate of decomposition occurred with radiation that could not be seen, but that existed in a region beyond the violence. 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