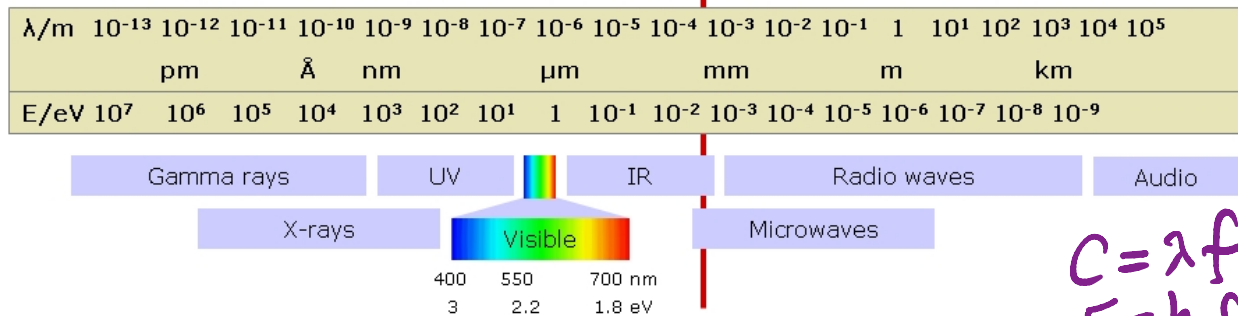


The Electromagnetic Spectrum

$k_B T_R$ - The thermal energy at room temperature



$$C = \lambda f$$

$$E = h f$$

Electromagnetic Radiation - Energy, Frequency and Wavelength

Type	Wavelength (m) λ	Frequency (Hz) f	Energy (eV) E
Electricity	$5 \cdot 10^5$	50 - 60	
Long wave, television	$10^5 - 10^2$	$< 3 \cdot 10^9$	
Short wave, radio	$10^2 - 10^1$	$10^8 - 3 \cdot 10^9$	$< 10^{-5}$
Microwaves	$10^{-1} - 10^{-3}$	$3 \cdot 10^9 - 3 \cdot 10^{12}$	$10^{-5} - 10^{-2}$
Infrared light	$10^{-3} - 7 \cdot 10^{-7}$	$3 \cdot 10^{12} - 3 \cdot 10^{14}$	$10^{-2} - 2$
Visible light	$7 \cdot 10^{-7} - 4 \cdot 10^{-7}$	$4.3 \cdot 10^{14} - 7.5 \cdot 10^{14}$	2 - 3
Ultraviolet light	$4 \cdot 10^{-7} - 10^{-9}$	$7.5 \cdot 10^{14} - 3 \cdot 10^{17}$	$3 - 10^3$
X-rays	$10^{-9} - 10^{-11}$	$3 \cdot 10^{17} - 3 \cdot 10^{19}$	$10^3 - 10^5$
Gamma rays	$10^{-11} - 10^{-13}$	$3 \cdot 10^{19} - 10^{21}$	$> 10^5$
Cosmic rays	$10^{-13} - 10^{-20}$	$10^{21} - 10^{25}$	

* eV = electron-volts

Figure 2: The electromagnetic spectrum, which is the range of all possible electromagnetic radiation. Note that $1K = 8.625 \times 10^{-5} eV \sim 10^{-4} eV$. Also, nearly all objects in the universe emit, reflect or transmit some light. The distribution of this light along the electromagnetic spectrum (called the spectrum of the object) is determined by what the object is made of.

$$1 K = 8.625 \times 10^{-5} eV$$

$$1 eV = 1.16 \times 10^4 K \quad (Kelvin)$$