Some Basic Facts about Waves

Physics II: Modern Physics

College of the Atlantic

A wave is described by the following equation:

$$z(x,t) \;=\; A\cos(kx - \omega t)\;. \tag{1}$$

The picture is that there is a wave traveling in the x-direction. The wave is oscillating in the z-direction. In the above equation

1. k is the **wavenumber**. It has units of 1/length.
2. ω is the **angular frequency**. It has units of 1/time.
3. A is the **amplitude** of the wave.

Other wave properties and relationships:

1. The **wavelength** $\lambda = \frac{2\pi}{k}$: The length of one full cycle of the wave.
2. The **frequency** $\nu = \frac{\omega}{2\pi}$: The number of cycles of the wave that occur in one second. Frequency is also denoted f.
3. The **period** $T = \frac{1}{\nu}$: The time for one complete cycle of the wave.
4. The speed v at which a wave travels is given by $v = \nu\lambda$. Electromagnetic waves (in a vacuum) travel at the speed of light, c.
5. The speed of light is the speed of light is $c = 3.00 \times 10^8$ m/s.
6. A **Hertz** is a unit defined by $1\text{Hz} = \frac{1}{\text{second}}$.

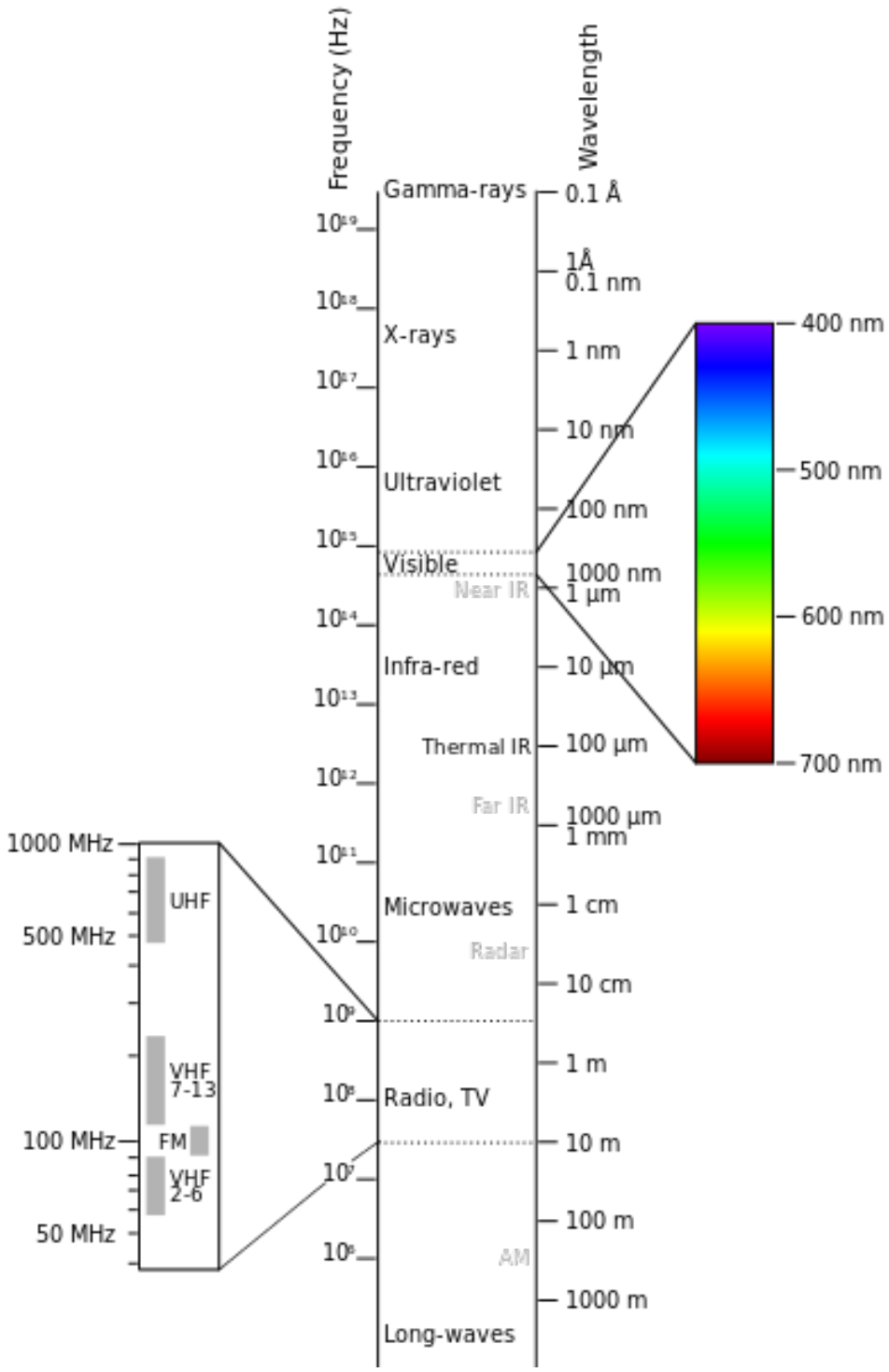

Figure 1: The electromagnetic spectrum. Figure source: Victor Blacus, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license. `https://en.wikipedia.org/wiki/File:Electromagnetic-Spectrum.svg`