Planck Units – *The Technical 10% You Need to Know.* Ver 1.0

Source: "*Cosmometry – Exploring the HoloFractal Nature of the Cosmos*" by Marshall Lefferts (p = page #s)
Source: Resonance Science Foundation's Delegate Course by Nassim Haramein (NH) (x.y.z = course section #)

In 1899, Planck proposed a series of completely *natural units* based on the properties of fundamental physical theories. These natural units are thus based only on observed properties of the universe — the universal constants. So instead of using a measuring standard created by humans, Planck's units are calculated directly from the universal physical constants, namely the gravitational constant, G, the speed of light, c, and the Planck constant h. Interactions between base Planck units can then be used to derive other units. For example, if 1 Planck length separates two bodies of 1 Planck mass each, they have a gravitational attractive force of 1 Planck force. At the speed of light, the time it takes light to travel 1 Planck length is 1 Planck time. This approach drastically simplifies the use of some large natural units, and reveals relationships between certain properties in the world. NH 3.5.3

Planck Length:

$$l_P = \sqrt{\frac{\hbar G}{c^3}}$$

$$= 1.616\,199(97) \times 10^{-35}\ \text{m}$$

Planck Mass

$$m_P = \sqrt{\frac{\hbar c}{G}}$$

$$= 2.176\,51(13) \times 10^{-8}\ \text{kg}$$

The Planck length represents the smallest limit of length we know how to measure. The reason for this is that all of our measurement ability in the current age is based on light. The smaller the wavelength of light we can produce, the smaller the objects we can shine that light upon and measure. In order for a photon to have a wavelength small enough to measure the Planck length, it would need to have an immensely high energy level. In fact, it would need to be so high that the photon itself would match the conditions of a black hole. NH 3.5.3

The maximum possible energy a photon can have (before collapsing on itself) is approximately equal to the "Planck energy," and the wavelength of the photon at this level is approximately equal to the Planck length. Since this wavelength is the smallest wavelength that light can travel, it's also the lower limit of what we currently believe we could be capable of measuring, though our technology is not yet capable of generating light at these immensely small wavelengths. It's a natural length unit that emerges from the properties of light and gravity in the universe, and so it's the most accurate "tick on a ruler" we currently have to measure the universe. This is essential to understanding Quantum Gravity. NH 3.5.3

Planck Force

$$F_P = \frac{E_P}{l_P} = \frac{\hbar}{l_P t_P} = \frac{c^4}{G}$$

$$= 1.21027 \times 10^{44}\ \text{N}$$

Planck Time

$$t_P = \frac{l_P}{c} = \frac{\hbar}{m_P c^2} = \sqrt{\frac{\hbar G}{c^5}}$$

$$= 5.391\,06(32) \times 10^{-44}\ \text{s}$$

The Gravitational Constant is an empirical physical constant involved in the calculation of gravitational effects in Sir Isaac Newton's law of universal gravitation and in Albert Einstein's general theory of relativity. It was first measured in 1798 by Henry Cavendish.

There is no experimental proof the photons have zero rest mass. NH 3.5.3

It is important to note that in the standard model of quantum mechanics, photons are not considered to have mass or size. They are considered "point particles." The reason that photons cannot have mass according to the standard theory is that if they did, they would not be able to travel at the speed of light, or they would have infinite mass and infinite energy. Yet, from a Unified Physics perspective, light may not travel at all. We know from Einstein's work that time does not exist at light speed. This may mean that light is already distributed throughout the Universe in a standing wave, and we are only observing local fluctuations of its frequency. In fact, this may actually be what the quantum vacuum fluctuations are all about! NH 3.5.3

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