The Relationship of Planck Constants and Wave Constants

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Abstract: Originally proposed in 1899 by Max Planck, the Planck unit system simplifies equations in physics, yet the meaning of each constant in the system is not well understood. The Planck mass is far heavier than an electron or proton while the Planck length is orders of magnitude smaller than these same particles. What do these units mean? When using wave equations to describe energies and forces of particles, the Planck units have meaning when mapped to new wave constants.

Constants

The following fundamental physical constants, referred to here as classical constants, are listed using CODATA values [1]. In addition, wave constants that appear in Energy Wave Theory (EWT) equations are provided in terms of values and units [2].

Classical Constants			Wave Constants		
Symbol	**Definition**	**Value (units)**	**Symbol**	**Definition**	**Value (units)**
c	Speed of light	299,792,458 (m/s)	c	Wave speed	299,792,458 (m/s)
m_P	Planck mass	2.17643×10^{-8} (kg)	ρ	Density (aether)	$3.859764540 \times 10^{22}$ (kg/m^3)
q_P	Planck charge	1.87555×10^{-18} (m)	A_l	Amplitude	$9.215405708 \times 10^{-19}$ (m)
r_e	Electron radius	2.81794×10^{-15} (m)	λ_l	Wavelength	$2.854096501 \times 10^{-17}$ (m)
l_P	Planck length	1.61625×10^{-35} (m)	g_λ	Electron orbital g-factor	0.9873318320
t_P	Planck time	5.39125×10^{-44} (s)	g_A	Electron spin g-factor	0.9826905018
μ_0	Magnetic constant	1.25664×10^{-6} (kg/m)	g_p	Proton orbital g-factor	0.9898125300
K_e	Electron wave count	10			
e	Euler's number	2.71828			

Table 1 – Values and units of classical and wave constants used in this paper.

Planck Mass and Density

Density is a property that describes a mass in a given volume, with SI units of kg/m^3. In EWT, density is a property of space, which may be considered as *spacetime* in modern theories or *aether* in older theories. It describes the physical substance of space that allows waves to travel.

Fig. 1 describes a sphere with Bohr radius (a_0) and a known density (ρ), which can be described as a material filling the space of a hydrogen atom. The individual components that create this material will be referred to as *granules*. If the masses of all granules within this radius are collapsed into a single particle, the particle would have a mass of Planck mass (m_P) as illustrated in the center of the next picture. As it will be shown, density within the sphere remains the same because mass and volume are constant for both the left and center illustrations of Fig. 1. On the right side of the figure, the magnetic constant (μ_0) is described as a linear density. All three will be proven to be the same value and related in this section. All three are significantly dense at 4 x 10^{22} kg/m^3. Yet this density does not imply that particles within this volume are massive. Like a spring-mass system, energy is only recognized when a mass is displaced from equilibrium.

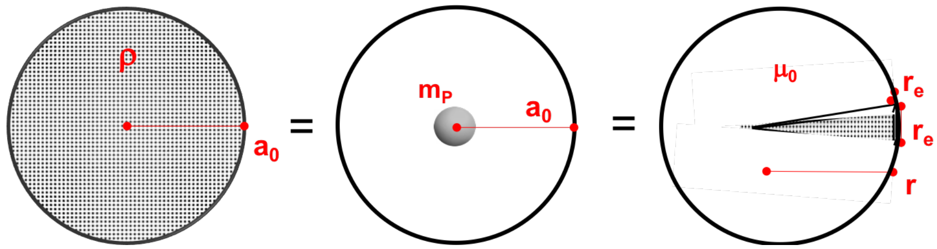

Fig. 1 – Density. Evenly spread granules (ρ) (left); Concentrated mass (m_P) to center granule (center); Linear density (μ_0) (right).

The density of the Planck mass within a hydrogen atom (center of Fig. 1) can be described by the following equation, which is mass divided by a spherical volume with a radius of the Bohr radius ($4/3\pi a_0^3$). When rounded, it is 4 x 10^{22} kg/m^3.

$$\rho = \frac{m_P}{V_{a0}} = \frac{m_P}{\frac{4}{3}\pi a_0^3} = 4 \cdot 10^{22} \left(\frac{kg}{m^3}\right) \qquad \textbf{(1)}$$

Many calculations in physics include the magnetic constant, or its counterpart, Coulomb's constant which differs by c^2 and 4π. The magnetic constant itself can be derived in units to be kg/m, which means it is a linear density property. Thus, the constant is hiding a length property in its denominator – which is the electron's classical radius (r_e). Since it already includes an electron length in the magnetic constant, to complete a volume V_{re}, it only requires the square of the electron radius ($4/3\pi r_e^2$). When rounded, it is once again 4 x 10^{22} kg/m^3, showing that the same density within the sphere of the electron is the density within the sphere of hydrogen.

$$\rho = \frac{\mu_0}{V_{re}} = \frac{\mu_0}{\frac{4}{3}\pi r_e^2} = 4 \cdot 10^{22} \left(\frac{kg}{m^3}\right) \qquad \textbf{(2)}$$

Fig. 1 also describes a volume in the shape of a pyramid, which is the shape often used to describe forces that decline at the square of distance from the source. When measuring a force between an electron and another particle, this is the volume ($V=1/3\ r_e^2 r$), that describes the interaction, and eventually cancels the r_e^2 in the denominator of Eq. 2, such that it leaves $\mu_0/4\pi$ - typical in many equations.

The density value used in EWT equations is based on the magnetic constant. Although g-factors are used for all wave constants when compared to classical constants because of the frame of reference being used. EWT wave constants assume the universe as the reference frame. Classical constants are calculated from measurements on Earth, which itself is in motion within the universe. G-factors are used in EWT to account for this slight difference (all three g-factors are ~0.98). The exact value calculated for EWT density is:

$$\rho = \frac{\mu_0}{\frac{4}{3}\pi r_e^2} g_\lambda^1 g_A^{-2} = 3.86 \cdot 10^{22} \left(\frac{kg}{m^3}\right) \tag{3}$$

Density is a property that can be derived from either Planck mass or from the magnetic constant.

Planck Charge and Amplitude

Planck charge can be expressed in units to be a length (meters), and not Coulombs. This resolves energy and force equations for particles that use charge, and larger objects that use mass as properties. This was reported in *The Relationship of Mass and Charge* [3]. In a longitudinal wave, charge is the displacement of a granule. While Planck charge (q_P) is maximum displacement from peak-to-peak, longitudinal wave amplitude (A_l) is the displacement from equilibrium-to-peak, as illustrated in Fig. 2.

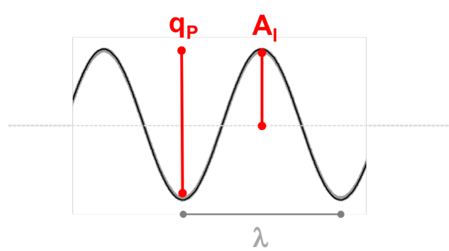

Fig. 2 – Amplitude. Planck charge (q_P) peak-to-peak displacement. Wave amplitude (A_l) equilibrium-to-peak displacement.

As amplitude is half (½) the value of Planck charge, it can be written as follows in Eq. 4. Once again, a g-factor is used to calculate the final value used in EWT equations.

$$A_l = \frac{q_P}{2} g_A = 9.22 \cdot 10^{-19} \, (m) \tag{4}$$

Amplitude is a property that can be derived from the Planck charge.

Electron Radius and Wavelength

Although the electron's radius is not a Planck unit, it is a fundamental physical constant. The wavelength property from EWT can be derived from this property, and it will also be shown that it can be derived from another Planck unit – the Planck charge.

In wave constants, wavelength (λ_l) represents the distance between troughs in a longitudinal wave. In EWT, particle energies can be calculated as standing, longitudinal waves, as amplitude and wavelength increase proportionally due to the number of *wave centers* (K) at its core [4]. A particle's radius is based on wavelength and increases at the square of the number K. The electron was determined to have a K value of 10 in EWT (K_e=10), meaning that wavelength increases 10 times, and there are 10 total wavelengths to the boundary of standing waves before it transitions to traveling waves. This is a total factor of 100x.

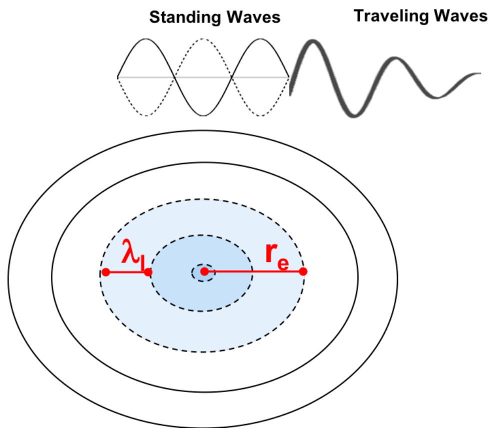

Fig. 3 – Wavelength (λ_l) and the relationship to the electron classical radius (r_e). *Not to scale.*

Since there are K_e^2 (100x) the number of longitudinal wavelengths in the electron's radius, this number is divided in Eq. 5. Again, a g-factor is used to determine the final value used in EWT equations.

$$\lambda_l = \frac{r_e}{K_e^2} g_\lambda^{-1} = 2.85 \cdot 10^{-17}\,(m) \tag{5}$$

It's worth noting the use of Euler's number (e) in deriving the longitudinal wavelength constant. In a paper on the *Geometry of Spacetime and the Unification of Forces* [5], it was found that the following matches the wavelength property.

$$\lambda_l = 2q_P e^2 = 2.8 \cdot 10^{-17}\,(m) \tag{6}$$

In the same paper, it was found that the Bohr radius divided by the unit cell of length $2*l_P*e$ results in the famous number known as Avogadro's constant (6.022×10^{23}). Compare this use of Euler's number to the wavelength property for Planck charge above in Eq. 6, where it is $2*q_P*e^2$. It shows that Euler's number appears as a natural growth function to lengths – Planck charge and Planck length.

$$N_A = \frac{a_0}{(2l_P e)} = 6.022 \cdot 10^{23} \tag{7}$$

Wavelength is a property that can be derived from the electron's classical radius or the Planck charge.

Conclusion

The Planck constants for mass and charge have meaning in terms of wave constants. The Planck mass is a measurement of density when the volume is considered to be the sphere within which a proton and electron are stable – the most abundant element in the universe – hydrogen. The Planck charge is not only used for wave amplitude (1/2 the value for equilibrium-to-peak), but also for wavelength when using Euler's number. Wavelength is also determined from the electron's classical radius as a second method. They simplify equations because they have physical meaning – in terms of waves.

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