Unveiling Planck Charge

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Abstract

Planck charge has been principally misunderstood. This physical constant is an active part of our universe, but has little to do with electric charge. Planck charge is the "charge" value of a force which is not electrostatic in nature. We will illustrate some of the significance of this discovery which was first conceived by Planck more than 100 years ago.

With Planck's discovery of the quantization of action, E=hv, came a set of new "constants" which were proposed. Among them was Planck charge. The value of Planck charge is about 11.70624 times greater than electric charge. We will show that this "charge" is not electrostatic in nature, but is rather the "charge" of a different force with which we are (only slightly) acquainted.

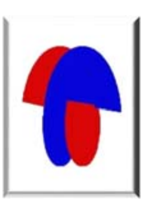
The Quantization of Action

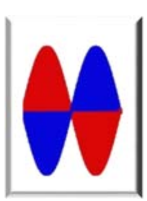
If action is quantized in space, in a universal manner, then there must be a mechanism, a force of nature, which causes this quantization. E=hv may well apply to all energy as it propagates through space. Meaning that fermionic particles, and light (photons) are quite specifically quantized.

Spin angular momentum is such an inherent property, noticed in experiment, and attributed to all particles.

We therefore suggest then, it is also likely that photons are rotational transverse waves in a medium of space.

Let us envision a simple and crude model for the structure of such a photon. Such a model





would show the displacement of the medium of space, for this rotational transverse wave, as "positive" and "negative" regions, rotating and moving forward. Since the photon would make one revolution in one wavelength (for reasons we will address) it would be a helical wave structure as shown in the illustration at the far left. If we view this photon from the side, perpendicular to the direction of travel it would be modeled as shown in the second illustration. We are not saying that this is exactly the form for all photons, or any photon, but rather using this simplified illustration for discussion and exploration of quantization of action.

For such a model the mathematical definition would be as follows:

$$p = \frac{E}{c}$$

Where *p* represents longitudinal momentum of the photon, E represents the energy of the photon, and c represents the speed of light.

$$\lambda = \frac{h\,c}{E}$$

Where *h* represents Planck's constant, and λ represents the photon wavelength.

For quantization, this rotational wave would have an action radius *r*:

$$r = \frac{h\,c}{2\pi\,E} = \frac{\lambda}{2\pi}$$

So that the spin angular momentum of the photon would be the reduced Planck's constant ħ.

$$\hbar = p\,r$$

But in order for this rotational wave to be quantized in this manner it must be confined to its action radius by a force. We will call this force of confinement F_c. That force F_c would then be:

$$F_c = \frac{p\,c}{r} = \frac{\hbar\,c}{r^2}$$

However there is another way to calculate this force:

Planck charge is stated as being:

$$q_P = \sqrt{4\pi\,\varepsilon_0\,\hbar\,c}$$

Now we can calculate F_c using the value of Planck charge:

$$F_c = \frac{p\,c}{r} = \frac{\hbar\,c}{r^2} = \frac{{q_P}^2}{4\pi\,\varepsilon_0\,r^2}$$

Rather than being an expression for electric charge, Planck "charge" is an expression for the confinement force "charge" which causes the quantization of action which Planck discovered.

The confinement force engendered by this type of "charge" is much stronger than the force of electric charge.

For an example let us show the relationship between this force of confinement F_c generated by Planck "charge", to the force of electric charge at the same distance.

The force of two electric charges separated by the distance r is:

$$F_e = \frac{e^2}{4\pi\ \varepsilon_0\ r^2}$$

Where F_e represents the force of electric charge, and e represents the elementary electric charge.

When we compare these forces we obtain:

$$\frac{F_e}{F_c} = \alpha$$

Where α represents the fine structure constant.

In this brief summary so far we have shown that the force of confinement which would support Planck's quantization of action is the same strength as the *strong nuclear force*. And we have shown that we can use Planck's "charge" to do an initial calculation of that force.

Caveat: Planck's charge is not exactly in the form, or of the value we need to show explicit cause for the force of confinement F_c. It is not logically accurate to assume that this force acts at the radius distance of the action radius. A more causal approach is to calculate a "charge-like" constant which operates across the action diameter. The opposite ends of the displacement of the medium are much more likely to be the cause for confinement of rotational waves of energy. So the action distance would then be the action diameter or two times the action radius, 2*r*. In this manner Planck charge creates the boundary conditions for the confinement of the particle.

So the more useful term for the photon model would be:

$$q_{FC} = \sqrt{8\pi\ \varepsilon_0\ \hbar\ c}$$

Where q_{FC} is the "charge" term for the type of charge which creates the confinement force in the photon.

Then the solution for F_c for the simple rotational wave of the photon becomes:

$$F_c = \frac{p\ c}{r} = \frac{\hbar\ c}{r^2} = \frac{{q_{FC}}^2}{4\pi\ \varepsilon_0\ 2r^2}$$

Modes of Confinement

A transverse rotational wave as in this photon model, is confined in two dimensions but free to move at the velocity c in the third. In elementary fermions, like the electron, the spin mode is different for the confined wave. In the photon the wave spins about its center, with opposite regions of the q_{FC} on either side. So let us compare a photon (with the energy of the electron) to the electron itself. In the electron the wave of energy is not circulating in the same manner as it does in the photon. The electron wave configuration confines the wave to be a structure at rest (making the wave momentum behave as inertial mass). The wave in the electron rotates around a point which is half the distance of the equivalent photon radius displaced from the "center" of the wave.

Note: This electron spin mode configuration can only be realized when the energy of the wave is high enough to support this spin mode.

In this electron wave configuration the wave is smaller, but with the same amount of energy. The mean energy transport radius of the electron wave is half that of the energy equivalent photon. And in the electron the efficiency of creating the "charge" for the confinement force is half that of the photon (due to this offset spin topology and the compressed nature of the wave). So in order to calculate the confinement force for the electron:

$$q_{FC} = \sqrt{4\pi\, \varepsilon_0\, \hbar\, c}$$

$$F_c = \frac{p\, c}{r} = \frac{\hbar\, c}{r^2} = \frac{{q_{FC}}^2}{4\pi\, \varepsilon_0\, 2r^2}$$

So that this charge term for the confinement force is quantized at one of two values. One value supports spin 1 particles (bosons), and the other quantization value supports spin ½ particles (fermions).

So the solution for the two possible levels of quantization for this "charge" is:

$$q_{FC} = \sqrt{S\, 8\pi\, \varepsilon_0\, \hbar\, c}$$

Where S represents the spin number of the particle (S = 1 or S = ½).

In all particles we can also see:

$$F_c = \frac{E}{r}$$

Summarizing for Fc:

$$F_c = \frac{p\, c}{r} = \frac{\hbar\, c}{r^2} = \frac{{q_{FC}}^2}{4\pi\, \varepsilon_0\, 2r^2} = \frac{E}{r}$$

In solving for Fc of the electron at rest, using any of the above solutions, we find magnitude of the confinement force to be 0.42402734471 kgf or 4.15828776 N.

Summary and Conclusion

We have discussed a cause for Planck's quantization of action, E=hv. In doing so we have illustrated a force of confinement which is the same value as the strong nuclear force. It is therefore likely that this universal force governing the quantization of action should be called the "force of confinement" rather than the "strong nuclear force". We first noticed and identified this force in the nucleus, but as we have shown, this force is everywhere.

A term similar to Planck charge seems to be the source for setting up quantization boundary conditions for confinement of energy in all particles.

Max Planck was really onto something important with E=hv, and with the suggestion of Planck charge.