Waves in Space

Let us start with the premise that the Force of Displacement (fundamental energy) would be the force which causes the differential displacement of two components of space. When the "electrically positive" type of displacement occurs in one direction, the "electrically negative" type of displacement occurs in the opposite direction.

When we look at Planck's quantization of action we see some simple relationships which illustrate the way that waves move in space. The time it takes for one wavelength to pass a point in space, for example, is simply $t = \frac{h}{E}$. This shows that resonant conditions are changed by energy content. Energy causes an increased tensioning. The wave becomes smaller with more energy. This may be counterintuitive, for it is opposite the way we normally see waves in massive material media. But this is how space behaves regarding the energy in waves. If we want to more fully define a simple sine wave in such a medium, we can do so by using Planck's quantization of action as a guide. But as we do so, let us look also at the causes for the behavior of these waves.

Such a wave reaches its maxima at $t = \frac{h}{4E}$ and its opposite maxima at $t = \frac{3h}{4E}$. Let us discuss the possible forces which cause this wave to exist and to maintain itself. First let us innumerate two forces at play here. F_d the **F**orce of **D**isplacement would be the force of energy which causes the differential displacement of two components of space. F_c the **F**orce of **C**onfinement would be an equal and opposite reaction, which space applies to normalize the displacement force. However these two forces are not equal at all points and all times, otherwise there could not be any wave action. A simple view is that the opposing force simply develops slightly slower than the displacement.

The photon can exhibit a spin of ħ. So if we have a wave which is traveling forward at the velocity c and has a spin of ħ, we would have the following conditions:

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

When confinement force is present, that force acts against displacement and slows displacement velocity. Confinement force is present when there is sinusoidal movement of energy. So in circumstances where there is spin, or wave action, the force is present.

These conditions allow for a rich set of possible configurations of a propagating wave structure.

Spin angular momentum is that angular momentum which has its center at the longitudinal axis of motion of the wave. If only spin angular momentum is present, the differential displacement is centered on this axis of longitudinal motion. But if the axis of motion is offset from the center of differential displacement, the force F_c and the accelerations of the displacement are "self-correcting" so that the force F_c continually moves the offset of the differential displacement towards the center, the axis of longitudinal motion. This causes a larger helical motion of the differential displacement, which is just orbital angular momentum.

For a sine wave in space, using a simple form of that wave, if the formula $p = \Delta F_c \sin(\theta)\, t = \frac{E}{c}$ is correct, then we know the angle is approximately 11.3 degrees, and the time *t,* is the time required for the wavelength to pass a point in space at the velocity c. So if energy is naturally propagated through space in the form of sine waves, we can calculate the ΔF_c component. Let us use the gamma ray “photon” with the energy of an electron as an example. As a reminder, the term ΔF_c (delta F_c) is the difference in the force F_c which confines the leading and trailing portions of the differential displacement as it moves through space.

Momentum $p = \frac{E}{c} = \frac{8.18710478684506\text{E}-14}{299792458} = 2.73092420051643\text{E} - 22$

Time $t = \frac{h}{E} = \frac{6.62606896E-34}{8.18710478684506\text{E}-14} = 8.09329931949410\text{E} - 21$

Delta F_c Momentum $p = \Delta F_c \sin(\theta)\, t = \Delta F_c \sin(\theta)\; 8.09329931949410\text{E} - 21$

For each half of a sine wave the angle of incidence for the force F_c is $\theta = 30, \sin(\theta) = 0.5$

Which yields $p = 2.73092420051643\text{E} - 22 = \Delta F_c\; 4.04664965974705\text{E} - 21$

So that $\Delta F_c = \frac{2.73092420051643\text{E}-22}{4.04664965974705\text{E}-21} = 0.067486055$

Confinement force is $F_c = \frac{\hbar\, c}{r^2} = \frac{E^2}{\hbar\, c} = \frac{E}{r} = 0.212013683$

So that the ratio, in this example, between ΔF_c and F_c is: $\frac{F_c}{\Delta F_c} = 3.141592654 = \pi$

$$\Delta F_c = \frac{F_c}{\pi}$$

This delay in the development of the force opposing displacement can be the cause of wave motion in space, then electromagnetic waves *could be continuous* and not strictly quantized. Yet mass carrying particles would be inherently quantized.

The simple mechanism suggested here can provide for a means of providing motion (and an impulse we measure as momentum) to the differential displacement of space, the most basic form of energy. Of course, now that we have such an envisioned mechanism we can delve into the details to see how well concept fits.

The delay we have suggested above can be calculated. Since the following relationship would be valid:

$$\Delta F_c = \frac{E^2}{\boldsymbol{\pi}\,\hbar\, c}$$

If F_c is then simply a slightly retarded sine wave which follows the displacement sine wave (the most likely scenario) we can more fully characterize F_c from this information.

So we can find the area under the curve F_c for the portions of F_c which occur before and after the displacement sine wave maxima so that ΔF_c is equal to $\frac{F_c}{\pi}$. The solution would then be:

$$F_{c1} = (1 - \cos(\varphi))F_c$$
$$F_{c2} = F_c - F_{c1} = (1 + \cos(\varphi))F_c$$

Where $F_{c1} + F_{c2} = F_c$, and $\Delta F_c = F_{c2} - F_{c1}$.

$$\Delta F_c = \frac{F_c}{\pi}$$

$$\varphi = \left(\cos^{-1}\left(\frac{\Delta F_c}{2F_c}\right) + Ꞷ\right) - 90^\circ$$

Where Ꞷ is the physical constant **3.3057041341356**.

So that for this example:

$$\varphi = \cos^{-1}\left(\frac{0.067486051}{0.424027365}\right) + 3.3057041341356 = 108.5607447°$$

$$108.5607447° - 90° = \mathbf{18.56074472}°$$

The persistent phase shift φ of F_c related to the displacement is the phase angle which yields $\Delta F_c = \frac{F_c}{\pi}$
.

The persistent phase shift φ is of F_c related to the displacement is 18.560744716896 degrees regardless of the energy content (frequency) of the wave.

The *time delay* associated with this phase shift is:

$$t_\varphi = \frac{Ꞷ_t\, h}{E}$$

Where $Ꞷ_t$ is the physical constant **19.3957734719711**. And t_φ varies (becomes smaller) with energy.

At the displacement maxima, the force of F_c exactly equals the force of displacement. However the force F_c reaches maxima 18.56074472° degrees later. This excess force at the trailing edge of the displacement is a force which could reverse the displacement, sustain the sine wave, and cause forward momentum.

We have just discussed a condition which, when extended, illustrates cause for Planck's Rule (*E=hv*), and Maxwell's equations. But it does more than that. It illustrates cause for momentum in energy propagating through space (light), cause for both spin and orbital angular momentum, and a confinement force which can create elementary fermions from this differential displacement (energy) in space.

And of course once we have a cause for momentum, and confinement, we then also have a cause for inertia and mass.

We can state in simple terms that, if the force which opposes a differential displacement of space develops slightly slower than the displacement itself, then *space will cause energy to always move*. Energy may then have a specific velocity, and *will display an impulse which we would measure as momentum*.