the general science journal

Primary Particle, the Relation of Particle Mass to its Velocity and Wave Length or Frequency, Integration of Gravitational and Electromagnetic Forces

Mohammadreza Tabatabaei

contact@ki2100.net

5 August 2010

De Broglie Electron Waves:

An important conceptual progress in quantum theory was made after a while in 1924. Louis de Broglie, a young French physicist, suggested in his doctoral dissertation that light waves behave like particles in certain conditions; particles also can behave like waves. Particularly, he presented that electrons formerly assumed like hard charged and impenetrable spheres, in fact can behave similar to light or water waves like widespread waves resulted of diffraction or interference.

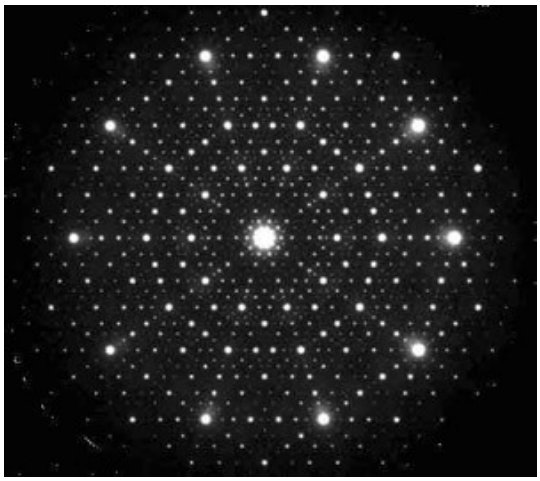
According to de Broglie's theory, a particle wavelength (λ), is inversely proportional to its momentum (P). Moreover, proportionality constant is Planck's quantum constant (h):

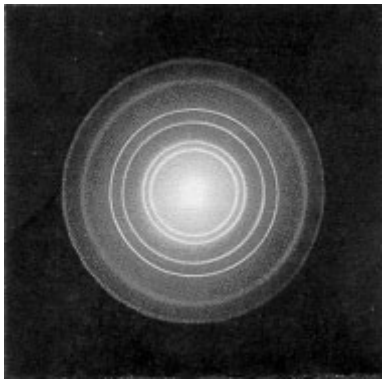
$$\lambda = \frac{h}{P}$$

It is not necessary to elaborate that the above equation is taken from equations of photon momentum given below:

$$P = \frac{h}{\lambda} = \frac{hf}{c} = \frac{E}{c}$$

Therefore, the greater the momentum of a particle, the shorter its wave length is. It is worth mentioning that de Broglie's theory is not only applicable to electron and other elementary particles but also applicable to all the particles. For example, a billiard ball rolling on a billiard table has a wavelength but because Planck's constant is very small, ball momentum is big in the same proportion. Wavelength of a billiard ball is about 10^{-34}m. This value is of course several orders of magnitude different from ordinary dimensions of a billiard ball. Therefore, a ball would never show a wave-like behavior. Typical momentum of electrons could make wavelengths of about 10^{-10} meters which are ordinary magnitudes in atomic distance scale. Hence, one can expect them to show wave characteristics while interacting with atomic structures. This was first shown by American physicists, Clinton Davidson and Lester Germer, in 1927. They proved that electrons could be diffracted by passing through lattice structure of a crystal in the same way of diffraction of light passing through a filter.





$$P = m_0 v$$

$$\lambda = \frac{h}{m_0 v}$$

$$Lim \frac{h}{m_0 v} = 0$$

$$\begin{cases} m_0 \to +\infty \\ v \to c \end{cases}$$

Where P stands for momentum, m_0 for a body or particle static mass, v for a body or particle speed, λ for wavelength and h for Planck's constant. As you know there is no static status in natural status of materials and particles in which speed equals zero. Therefore, wavelength would not be infinity.

$$\lambda = \frac{h}{m_0 v}$$

$$\lambda m_0 v = h$$

$$\begin{cases} m_0 = \dfrac{h}{\lambda v} \\ m = \dfrac{m_0}{\sqrt{1 - \dfrac{v^2}{c^2}}} \end{cases} \Rightarrow m = \frac{\dfrac{h}{\lambda v}}{\sqrt{1 - \dfrac{v^2}{c^2}}}$$

$$m = \frac{h}{\lambda v \sqrt{1 - \dfrac{v^2}{c^2}}}$$

c stands for speed of light. Now we can have a better understanding of the general concept of mass (m) in physics:

Mass of every particle or body is a result of its own vibration and speed or its constituents'.

The above relation determines mass of every particle or body only by knowing its wavelength and speed. For example, for a proton traveling by half of speed of light we have:

$$m0_{proton} = 1.6726\times 10^{-27}$$
$$v = 1.5\times 10^{8}$$
$$h = 6.626\times 10^{-34}$$
$$\lambda = \frac{6.626\times 10^{-34}}{1.6726\times 10^{-27}\times 1.5\times 10^{8}} = 2.64099\times 10^{-15}$$
$$m_{proton} = \frac{1.6726\times 10^{-27}}{\sqrt{1-\left(\frac{1.5\times 10^{8}}{3\times 10^{8}}\right)^{2}}} = 1.931352\times 10^{-27}$$

And now we can have relativity mass of a particle in motion just by knowing wavelength and speed and of course without knowing electric charge, static mass and even type of particle itself:

$$m_{proton} = \frac{6.626\times 10^{-34}}{2.64099\times 10^{-15}\times 1.5\times 10^{8}\sqrt{1-\left(\frac{1.5\times 10^{8}}{3\times 10^{8}}\right)^{2}}} = 1.931352\times 10^{-27}$$

It is obvious that static mass of a particle is also calculable just by knowing its wavelength and speed:

$$m_0 = \frac{h}{\lambda v}$$
$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{h}{\lambda v\sqrt{1-\frac{v^2}{c^2}}} \Rightarrow m_0 = \frac{h}{\lambda v}$$
$$m0_{proton} = \frac{6.626\times 10^{-34}}{2.64099\times 10^{-15}\times 1.5\times 10^{8}} = 1.6726\times 10^{-27}$$

The equation below shows the relation between mass of every particle or body and ratio of its frequency over speed:

$$\lambda f = c \Rightarrow \lambda = \frac{c}{f}$$

$$m = \frac{h}{\frac{c}{f} v \sqrt{1 - \frac{v^2}{c^2}}} = \frac{hf}{cv\sqrt{1 - \frac{v^2}{c^2}}} = \frac{hf}{v\sqrt{c^2 - \frac{c^2 v^2}{c^2}}}$$

$$m = \frac{hf}{v\sqrt{c^2 - v^2}}$$

A few questions rise here stating that: What is the general difference among particles in quantum mechanics? And how can motion and vibration of particles result in occurrence of mass and gravity force?

Certainly, general difference of particles is their mass and it seems that all the fundamental (elementary) particles at last have a unique identity, i.e. they are made of a unique particle while storing different amount of energy in themselves. As a result, they would have different masses and consequently, they would have different wavelengths and momentums in motion. It is predicted that finally this primary particle will be revealed in researches being done on particle accelerators. It is interesting that this particle has no mass, electric charge and consequently has no energy and momentum. It means a perfectly pure particle and no detector or method could be considered to identify it for now. But it would definitely have a very strong interaction with electromagnetic waves therefore it would be traceable and would create a new and known particle at once absorbing electromagnetic waves. As you know, the earthquake waves are divided into two groups in geophysics, P or longitudinal waves and S or transverse waves. The waves on the water surface are transverse while sound spreads in water and air longitudinally. Our final prophecy on this subject is that since wavelength of particles are due to their permanent vibration, these vibrations might be able to create and spread longitudinal electromagnetic waves which are the main factor to appearance of gravity force since motion of a

charged particle and its vibration generate and spread electromagnetic field and electromagnetic waves respectively. Of course as you know light is a transverse electromagnetic wave and it is very probable and logical for its longitudinal type to exist while it has not been recognized or generated by human yet. This point is important that Einstein's general theory of relativity is still a classic theory which does not take into account gravity in quantum mechanics field. No successful theory on quantum gravity has been formulated yet and the agreement between general theory of relativity and quantum mechanics is still a main issue in theoretical physics left unresolved. It might be wrong at all to make these two theories agree or merge. Anyway, in this subject we are trying to merge Newton's gravity force formulation and the recent relation obtained from combination of quantum mechanics and relativity equations to understand the identity of gravity force and to unify it with electromagnetic force. Assuming that two particles or bodies are stationary relative to each other and are in motion with the same velocity, we have:

$$F = \frac{Gm_1m_2}{r^2}$$

$$m_1 = \frac{hf_1}{v_1\sqrt{c^2 - v_1^2}}$$

$$m_2 = \frac{hf_2}{v_2\sqrt{c^2 - v_2^2}}$$

$$IF : v_1 = v_2 = v \Rightarrow F = \frac{G\frac{hf_1}{v\sqrt{c^2 - v^2}} \times \frac{hf_2}{v\sqrt{c^2 - v^2}}}{r^2} = \frac{\frac{Gh^2 f_1 f_2}{v^2\left(c^2 - v^2\right)}}{r^2}$$

$$F = \frac{Gh^2 f_1 f_2}{r^2 v^2 (c^2 - v^2)}$$

It states that gravitational force completely has an electromagnetic identity and we might be able to recognize or even generate and spread these waves in close future. Without considering relativity mass the above formulations would be:

$$\lambda f = c \Rightarrow \lambda = \frac{c}{f}$$

$$m_0 = \frac{h}{\frac{c}{f}v} = \frac{hf}{cv}$$

$$F = \frac{Gm_1m_2}{r^2}$$

$$m_1 = \frac{hf_1}{cv_1}$$

$$m_2 = \frac{hf_2}{cv_2}$$

$$IF: v_1 = v_2 = v \Rightarrow F = \frac{G\frac{hf_1}{cv} \times \frac{hf_2}{cv}}{r^2} = \frac{\frac{Gh^2f_1f_2}{c^2v^2}}{r^2}$$

$$F = \frac{Gh^2f_1f_2}{r^2c^2v^2} = \frac{Gh^2f_1f_2}{(rcv)^2}$$