A RECONCILIATION OF QUANTUM PHYSICS AND SPECIAL RELATIVITY

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ABSTRACT

According to existing theory the matter wave emerges from the Fourier addition of component waves. The wave packet propagates at velocity V. The potential and kinetic components of a wave retain their phase during a Fourier localization. The Fourier process cannot change the phase of a wave.

The matter wave is commonly described with Euler formula. The Euler formula is given in Equation #1. [1,2]

$e^{it} = \cos t + i \sin t$ Equation #1

The Euler formula describes the simple harmonic motion of a standing wave. The cos component represents the potential energy of a standing wave. The sin component represents the kinetic energy of a standing wave. The potential and kinetic components are displaced by 90 degrees. The localization of a traveling wave through the Fourier addition of component waves retains the phase of the component waves. To employ this method of localization and then to describe a wave of any velocity with the Euler formula is inconsistent. According to the Born interpretation the matter wave is not material. The matter wave is not constructed of potential and kinetic components. It is only a function of probability. This author contends that the matter wave is real. Disturbances in the matter wave propagate at luminal velocities. These disturbances are restrained by forces. The angular separation of matter’s potential and kinetic energy is variable. The phase of the angular separation establishes matter’s relativistic properties.

THE RESTRAINED MATTER WAVE

The potential and kinetic components of the restrained wave are displaced by 90 degrees.

A mass bouncing on the end of a spring is a good example of this type of harmonic motion. At the end of it travel the mass has no motion (kinetic energy = zero) and the spring is drawn up tight (potential energy = maximum). One quarter of the way into the cycle the spring is relaxed and the mass is moving at its highest velocity (kinetic energy = maximum). A similar harmonic motion is exhibited by the force fields. The energy of a force field oscillates between its static and magnetic components. Mass energy is a standing wave. The phase of a standing wave is 90 degrees. The energy of the standing matter wave (Mc^2) is represented on the i axis of a complex plane. See figure number one. All standing waves, including the matter wave, are localized by restraining forces.

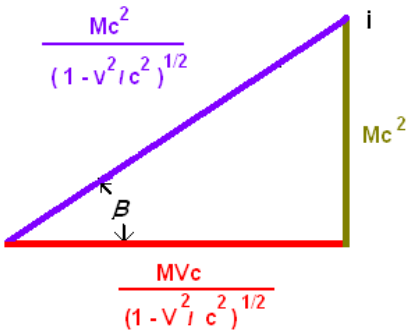

Figure #1

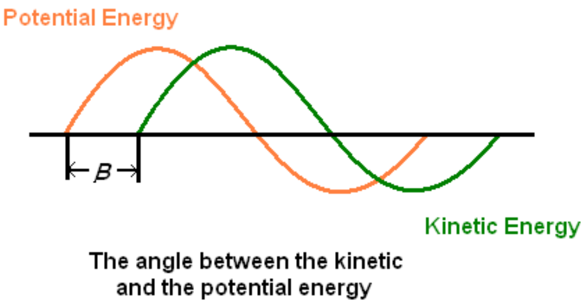

Figure #2

A traveling wave has its kinetic and potential components aligned in phase. A water wave is a good example of this type of harmonic motion. The wave's height (potential energy) progresses with the kinetic energy of the wave. The momentum "P" carried an energy flow of "E" is expressed in Equation #2 below.

$E = Pc$ Equation #2

The traveling wave expresses itself through its relativistic momentum "P".

$P = Mv / (1- v^2 / c^2)^{1/2}$ Equation #3

A simultaneous solution of Equations two and three is Equation number four. Equation number four represents the amount of energy that is in motion "E_x".

$E_x = Mvc / (1-v^2 / c^2)^{1/2}$ Equation #4

Energy flows are represented on the X axis of a complex plane. See figure one. The magnitude of vector sum of the standing (E_y) and traveling (E_x) components equals the relativistic energy (E_r) of moving matter.

$[E_r]^2 = + [E_y]^2 + [E_x]^2$ Equation #5

$[E_r]^2 = [Mc^2]^2 + [Mvc / (1- v^2 / c^2)^{1/2}]^2$ Equation #6

$E_r = Mc^2 / (1- v^2 / c^2)^{1/2}$ Equation #7

The relativistic energy is represented by the length of the hypotenuse on a complex plain. [3,4] See figure one. The ratio of standing energy to the relativistic energy [E_j / E_r] reduces to $(1- v^2 / c^2)^{1/2}$. This function express the properties of special relativity. The arc sin of this ratio is the phase β

$\beta = \arc \sin (1- v^2 / c^2)^{1/2}$ Equation #8

The phase β expresses the angular separation of the potential and kinetic energy of matter. See figure number two. The physical length of a standing wave is determined by the spatial displacement of its potential and kinetic energy. This displacement varies directly with the phase β. The phase β varies inversely with the group velocity of the wave. This effect produces the length contraction associated with special relativity.

Time is represented on the Z (out of the plain) axis on a complex diagram. The rotation of a vector around the X axis into the Z axis represents the change in potential energy with respect to time. The rotation of a vector around the i axis into the Z axis represents a change in potential energy with respect to position. Relativistic energy is reflected on both axes. The loss in time by the relativistic component E_r is compensated for by gain in position.

The phase β of a wave expresses the displacement of its potential and the kinetic energy. When placed on a complex diagram the phase directly determines the relativistic momentum, mass, time, and length. These effects reconcile special relativity and quantum physics.

The analysis reveals information not provided by special relativity. The ratio of traveling energy to the relativistic energy (E_x / E_r) reduces to v/c. The simplicity of the ratio suggests that it represents a fundamental property of matter. In an electrical transmission line this ratio is known as the power factor. The power factor is a ratio of the flowing energy to the total energy. The construct of Special Relativity may be derived from the premise that the group velocity of the matter wave is V and the phase velocity of the matter wave is c. The difference between these two velocities is produced by reflections. Reflections result from restraining forces. These principles apply to all waves in harmonic motion.

CONCLUSION

Matter waves are real. Disturbances in the matter wave propagate at light speed. These disturbances are restrained by forces. The energy of the matter wave oscillates between its potential and kinetic components. The physical displacement of matter potential and kinetic components establishes its relativistic properties.

NOTES

1. Euler, L. *Miscellanea Berolinensia* **7**, 179, 1743.

2. Euler, L. *Introductio in Analysin Infinitorum, Vol. 1*. Lausanne, p. 104, 1748.

3. A. Einstein, *On the Electrodynamics of Moving Bodies*, , Annalen der Physik, 17:891, June 30, 1905

4. H. Hayden, “Special relativity: Problems and alternatives”, Physics Essays *, 366-376 (1995)