

Geometrical interpretation of $(E=mc^{\text{squared}}) = (E=mc^{\text{circled}})$
or (energy in circular and /or spherical rotation)
and $c = (\sqrt{-1})$
By Conrad J Countess

Abstract

$E=mc^2$ tells us that allot of energy is trapped inside of matter and that they are equal, related through mathematical conversion factor, (c^2).

This geometrical interpretation gives the equation physical form, and illustrates how energy equals and turns to matter by acquiring a circular and/or spherical configuration.

These findings coincides with Compton's, and de Broglie's, ($E=hf=mc^2$) which indicate a smooth transition from EM waves to matter particles, (photons to electrons) along the same EM spectrum which we can now clearly see is not just the EM as in (electro-magnetic) spectrum, but also the EM as in (energy-matter) spectrum.

http://en.wikipedia.org/wiki/Compton_wavelength

<http://www.calphysics.org/mass.html>

These also coincide with Bohr's idea that the wavelength of electron is equal to the circumference of a circle with an angular momentum of a multiple integer of $h/2\pi$.

<http://www.colorado.edu/physics/2000/quantumzone/debroglie.html>

Furthermore, I will demonstrate that ($c = \sqrt{-1}$)

Introduction

What I will do here is to give a geometrical demonstration of how a wave turns into a particle by acquiring circular and or spherical motion, thereby also demonstrating how ($E=hf$), the equation for EM waves, = ($E=mc^2$), the equation for matter, or ($E=hf=mc^2$), at the level of electron/positron, and Bohr's idea of how the, (wavelength of electron) = (circumference of circle), as I show how a wave turns into a circle and sphere.

Also I will show how a backward spinning (-1 charged), standing spherical wave, making two rotations (spin 1/2), in order to complete one wave cycle, logically and geometrically emerges from this, which is the current description of an electron. This and another geometrical description of $(\sqrt{-1})$, arrived at independently by another source, which I reference, and which coincides with my description of c^2 , prompts me to state that $c = \sqrt{-1}$. To state it more accurately, [(c) is the natural unites (square root), of the natural unite (-1)].

I will give a geometrical demonstration of how a wave turns into a particle, by acquiring circular and or spherical motion, because of the 90 degree angular momentum of the wave, being equal to the linear momentum. This creates a balance of centripetal and centrifugal forces, through a 90 degree arc, which if constant creates a circle, and also reveals that $(c = \sqrt{-1})$.

Historical Progression

- 1) In 1900 Planck discovered $(E=hf)$, for photons
- 2) In 1905 Einstein discovered $(E=mc^2)$, for electrons/matter
- 3) In 1924 deBroglie discovered $(E=hf) = (E=mc^2)$ or $(E=hf=mc^2)$ for electron of -1 charge, and that electron was also a wave.
- 4) In 1913 Bohr discovered that the wavelength of electron is equal to circumference of circle with angular momentum of a multiple integer of $h/2\pi$
- 5) Therefore it follows from this and following geometrical evidence, making it twice reinforced, that $(E=mc^2) = (E= mc^{\text{circled}})$ and $c=(\sqrt{-1})$

If we draw progressively shorter waves on a graph, with progressively higher energy, we will evidentially arrive at a wave whose 90 degree angular energy/momentum equals its linear energy/momentum, which create a balance of centripetal and centrifugal forces, and 90 degree arc, which if constant creates a circle in 2d, or a spherical wave in 3d, which happens if amplitude is constant, or we start with circular polarized wave.. This 3d wave makes two rotations in order to complete one wave cycle, (spin 1/2) with angular momentum $(h/2\pi/2)$, and also spins backward counter to it trajectory in half the cases, which is how electron gets its (-1 charge). In the other half of cases a forward spinning positron emerged of (+1 charge).

A smooth transition from photon to electron, energy to matter, along the same EM spectrum, which might from now on be called the (energy/ matter), spectrum as well as (electromagnetic), is geometrically demonstrated.

Geometrical illustration of $E = mc^2$

In this context, c^2 means c in the linear direction, for instance horizontal, times c in the 90 degree angular or vertical direction .

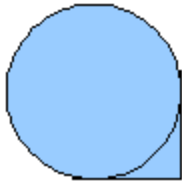
Analogous to a horizontal line times a vertical line of equal measure = a square. Illustrated below.



Two equal forces such as a centrifugal and centripetal force at a 90 degree angles to each other, exerted upon a planet, satellite, or an object attached to a string, will create orbital or circular motion with acceleration of $(a=v^2/r)$ and force of $(F=mv^2/r) = (F=Gmm/r^2)$.

See: <http://www.mathpages.com/home/kmath633/kmath633.htm>

In this context, c^2 means c in the linear direction, times c in the 90 degree angular or vertical direction = $c^2 = c$ in circular motion with angular momentum of $h/2\pi$ acceleration $a=c^2/c$ and $F=mc^2/r$.



The above graphic illustrates energy traveling at c along a 90 degree arc which if constant creates a circle. The arc is drawn between two equal lines of force at 90 degree angles to each other represented by the same 2 lines which can also create a square like the very first graphic. These two forces represent what is called the centrifugal and centripetal force balance that creates circular motion.

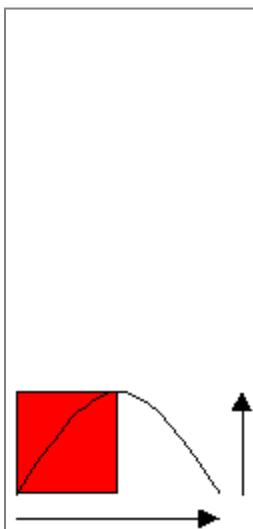
Is there any experimental evidence that electromagnetic waves carry momentum which can cause circular motion if 2 forces are at 90 degree angle to each other?

Yes see this:

“Light is an electromagnetic wave that can carry angular momentum by way of circular polarization. Transverse waves such as light, can have polarization in two directions, "left-right", "up-down" or any combination thereof. As an analogy, you can shake the end of a slinky up and down, left to right, or at some arbitrary angle. Linear polarization occurs when these two

components occur in phase, e.g. you shake the end of your slinky back and forth along the same path. When the two components are of equal amplitude but 90 degrees out of phase, however, circular polarization is created. This is what happens when you shake the end of your slinky in a circular motion.” From website: <http://www.physlink.com/Education/AskExperts/ae694.cfm>,"

We might extend the above logic base on experimental evidence to include that two similar components in the up/down and back/forth or x and y planes of equal amplitude and 90 degrees out of phase, may cause circular motion, along the x and y or (horizontal and vertical) plane, just as I have suggested. And that when this occurs in all three dimensions or x-y -z planes, that this might cause a 3D standing spherical wave. Perhaps experiments along the same lines as that mentioned on above web site will bear this out.

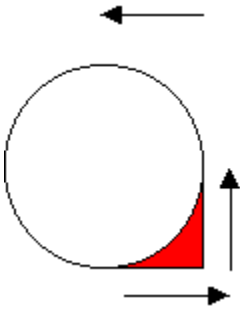
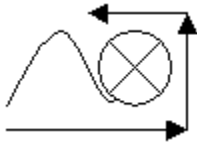


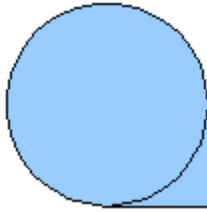
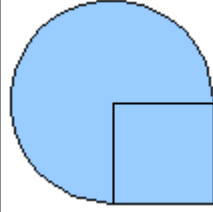
What is length of last photon before rest mass?

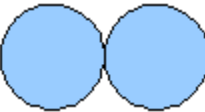

When energy moves in the x direction the same distance at the same time as it does in the y direction it is moving at c^2 represented by the wave inside the red square and moves from the bottom left corner of the square to the top right corner. The wave to the left represents a wave at c^2 that does not attain rest mass because it continues to move at c along the x axis and should not be permitted. Last photon wavelength must be a wavelength longer than this 2 square long wave. It should be 4 squares long, which as we will see is 4 spherical electron diameters long, which is also equal to 4 times the full amplitude, (positive and negative), of the wave.

In some cases the speed of a wave moving both horizontally and vertically would be the sum of its two vectors. In other words it is added, not multiplied. But if the two perpendicular vectors are equal, comprising a centripetal and centrifugal force balance to create a circular motion, than that velocity is said to be squared. This might indicate not only a quantum leap in the wave to a particle, but also in the mathematics that measure it as the two velocity vectors go from being additive to becoming multiplicative?

The length of the square would be of fundamental significance. The radius of electron as a circle, the diameter of electron as a sphere, the reduced Compton wavelength, the Schwartzschild radius. This would explain why squeezing it beyond this results in Black Hole according to GR and particle creation according to QM.

	<p style="text-align: center;">2D Approximation of Rest Mass</p> <p>If energy swings up from the bottom left corner of the red square at the velocity of c^2 its momentum should carry it over the top enabling it to make a backward circular motion and attain rest mass as the backward motion counter balances the forward motion of c and also gives the energy a more equal distribution around a center of rotation. The energy influenced by two equal forces such as a centrifugal and centripetal at 90 degrees to each other follow a 90 degree arc which if constant creates a circle. Notice how large circle of energy is compared to square. If amplitude is kept constant confined by square, it would take 2 rotations to complete 1 wave cycle and look more like the standing spherical wave below.</p>
	<p style="text-align: center;">Formation of a Standing Spherical Wave</p> <p>If the large circle is confined to the square, or we begin with 3d circular polarized wave, we could get a backward spinning, standing spherical wave, that makes 2 rotations in order to complete 1 wave cycle just as indicated above. This fits the description of an electron which is said to make 2 rotations in order to complete 1 wave cycle and get its -1 charge from its backward spin being counter to its trajectory. One could also get a forward spinning wave with positive charge or (positron), in some cases.</p>

 <p>One can see from this view that the 90 degree arc, which if constant creates a circle, can be formed from two lines at 90 degree angle to each other, just as the square can. This demonstrated geometrically, how the (speed of light squared) can be interpreted as (the speed of light circled) or $(c \times 2\pi)$ with angular momentum of $(h/2\pi)$ $c = h$, because h is the constant kinetic mass/energy that comes from the constant speed of light.</p>	 <p>Notice that the length of the square, (which is also the length that light travels in the linear direction, and/or the 90 degree angular direction, (in order to create the 90 degree arc), is equal to the radius of the circle. Sense circumference of a circle = $(\text{radius} \times 2\pi)$, this geometrical illustration coincides with Bohr's idea that wavelength of electron = circumference of circle with angular momentum of multiple integer of $h/2\pi$.</p> <p>"http://en.wikipedia.org/wiki/De_Broglie_hypothesis" "The de Broglie relations show that the wavelength is inversely proportional to the momentum of a particle"</p>
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	<p>just as $h \times 2\pi$ (wavelength) is inversely proportional to $h / 2\pi$ (momentum)</p>
 <p>If the large circular wave at top, is confined to the square, because the amplitude is kept constant, it will be folded in two and forced to make two rotations in order to complete one wave cycle (spin $1/2$). The combined diameters of the two smaller circles equals that of the larger. The combined circumference or wavelength of the smaller circles, equals that of the larger. This is because circumference = (diameter $\times \pi$) = $(r \times 2\pi)$. The wavelength making two rotations might equal $(1/2d + 1/2d \times \pi)$, while larger circle = $(1d \times \pi) = (r \times 2\pi)$. And so $(c^2 = h/2\pi = G)$ and $(r = c = h = i)$</p>	 <p>Consider this circle with a cross in it to represent the 2 circles at left facing us edge on, one spinning left to right in the horizontal (x and z) plane, and the other spinning up and down in the vertical (y and z) plane, while simultaneously rotating backwards along the x, y plane. This represents the circle of energy, making 2 rotations, at right angle to each other, to complete one wave cycle, which is, spin $(1/2)$, and creates a 3d standing spherical wave, with angular momentum of $(h/2\pi/2)$. In cases where it spins backwards counter to its trajectory giving it a (-1) charge, we can say that, $c =$ natural unit square root, of the natural unit -1, which is the electron, and is probably why $\sqrt{-1}$, works so well in solving problems in electronics.</p>

References concerning $\sqrt{-1}$

From: <http://mathworld.wolfram.com/MinkowskiSpace.html>:
Minkowski space is a four-dimensional space possessing a [Minkowski metric](#)

$$d\tau^2 = -(dx^0)^2 + (dx^1)^2 + (dx^2)^2 + (dx^3)^2.$$

Alternatively (but less desirably), it can be considered to have a [Euclidean metric](#) but with imaginary time coordinate $x^0 = ict$, where c is the speed of light, by convention $c = 1$ is normally used, and i is the [imaginary number](#) $\sqrt{-1}$. Minkowski space unifies Euclidean three-space plus time (the "fourth dimension") in Einstein's theory of special relativity.

From: <http://web.archive.org/web/20030410200416/www.virtualchaos.org/science/apndx.html>:
MINKOWSKI'S FOUR - DIMENSIONAL SPACE
("WORLD") [Supplementary to Section XVII]

We can characterize the Lorentz Transformation still more simply if we introduce the imaginary $\sqrt{-1}$ times ct in place of t as time-variable. If, in accordance with this, we insert

- $x_1 = x$
- $x_2 = y$
- $x_3 = z$
- $x_4 = \text{imaginary } \sqrt{-1} \text{ times } ct$

From: [http://web.archive.org/web/20030224085925/www.virtualchaos.org/science/sqrt\(-1\).html](http://web.archive.org/web/20030224085925/www.virtualchaos.org/science/sqrt(-1).html):

The Square Root of Negative One

Virtual Chaos

"With the opening simplification, we can now treat the time dimension in the same way as we treat the space one. The expression ct is the amount of space that light can travel [c] in a period of time [t]. This means that an amount of time can be given as a spatial length, as long as we multiply it by the square root of negative one.

Understanding the significance of this imaginary number would link space, time, matter, energy, gravity, and inertia, all to a single unit of conversion."

Conclusion

If c^2 or (c in both linear direction, and pointing straight up in 90 degree angular direction), creates 90 degree counter clockwise rotation or arc, which if constant creates a circle, and if this is also what creates a backward spinning, standing spherical wave, such as electron of -1 charge, than ($c = \sqrt{-1}$), and Einstein's and Minkowski's, ($ct \times \sqrt{-1}$) or ($c \times \sqrt{-1}$) = energy in circular and /or spherical rotation with rest mass and also = ($E=mc^2$)

And so (c^2) may be the (single unite of conversion/mathematical conversion factor), or more accurately, (geometrical conversion frequency), between **energy, matter, space, time, gravity, inertia, and charge**, and the natural cut off frequency, affecting need for renormalization, and running coupling constants problem.

<http://en.wikipedia.org/wiki/Renormalization>

http://en.wikipedia.org/wiki/Coupling_constant

<http://backreaction.blogspot.com/2007/12/running-coupling-constants.html>

Quantum Gravity in 3 steps by Conrad Countess

1. Dark energy in ground state at lowest frequency can be represented by straight line as pure centrifugal force, with velocity of c , and energy of h , before frequency is factored in. The velocity of light away from a center of origin, as an expansive centrifugal force, exerting force in the

direction of motion, can also represent, Cosmological Constant, Dark Energy, and Planck's Constant.

Represented by a straight horizontal unwavering line.

-----> c

2. As frequency builds, the mass-energy increase, with centripetal force of cycles per time unit, inversely proportional to the wavelength, and with the strength of $E = hf / c^2$ and $M = hf / c^2$. Increase frequency and corresponding shorter wavelengths are represented by vertical lines

c-----|-----|-----|--|>

3. When velocity of light in the 90 degree angular direction reaches c , this is c^2 , and balance of centrifugal and centripetal forces.

At c^2 , something analogous to "the speed of light in circular motion" and "rest mass", is attained. represented by a circle or O.

Therefore we can represent the whole idea this way
c-----|-----|-----|--|>O = c^2 = Rest mass

Straight horizontal line represents velocity of light, dark energy, cosmological constant, Planck's constant.

Vertical lines represent frequency as divisions of c^2
O represents c^2 and Rest mass

From here the Universe is built up in multiples and divisions of c^2 .

Conrad J Countess

3 Solutions to the "UNCERTAINTY PRINCIPLE"

1) If sub atomic particles exhibit both wave and particle properties, than they may exhibit something analogous to a "Doppler Effect", when something moves within their field, inducing the formation of a particle around the disturbance because of a change in the frequency of the wave, thereby causing a collapse of the wave function which represents a collapse of the wave itself. Richard Feynman in his book, "Six Easy Pieces", on page 129 paragraph 3 states that: "perhaps it was the turning on of the lights that disturbs things. It must be that electrons are very

delicate and the light when it scatters off the electrons changes their motion.....eliminating wave interference effects".

2) If waves and particles only exist as the product of Planck's constant times frequency or $(h \times f)$, then there can only be measurements of position and/or velocity with a product greater than h because this is necessary for their very existence. or $(h/2\pi/2)$ in the case of rest mass particles. And so $(h/2\pi/2)$ represents not the measure of uncertainty of the particle, but the actual certainty of the particles existence, both position and momentum, simultaneously.

3) And finally if we have demonstrated how a wave turns to a particle by acquiring circular and/or spherical motion at c^2 , there is no longer need to find the particle within the wave because the particle is the wave. Now $(E=mc^2)$, can coincide exactly with $[\psi(x,t)^2]$ which is the "Born interpretation of the Schrodinger wave function", solution to the probability of finding a particle at $(x$ position in t time). Accordingly, this can only be done if the equation is squared. I interpret this to mean that the highest probability of a particle being found in a wave, moving from $(x$ position in t time) is if the wave is squared, which transforms it into a circular wave or a standing spherical wave, which transforms it into particle that is sort within the wave along that trajectory. In other word the equation itself transforms the wave into a particle by squaring it.

References concerning "UNCERTAINTY PRINCIPLE"

See:

[arXiv:physics/0404044](https://arxiv.org/abs/physics/0404044) [pdf]

Title: What is rest mass in the wave-particle duality? A proposed model

Authors: [Donald C. Chang](#)

Comments: 14 pages, 2 figures. Comments welcome

Subjects: General Physics (physics.gen-ph)

"pages 8, 9

1. It provides a simple explanation for the "Uncertainty principle" of Heisenberg.

When one regards the particle as a point-like object, as in the traditional concept of quantum physics, it is very difficult to explain the "Uncertainty principle" of Heisenberg. We were usually told that this principle is an observation of nature, and we have not found any a priori explanation behind it [12]. If the particle is indeed a wavepacket representing the excitation of a real physical field, as suggested in this model, we can explain the "Uncertainty principle" in a straight forward way based on the wave nature of the "particle". As shown in Eq. (16), the longitudinal component of the wave function has a phase angle $(k \cdot x - \omega t)$. Because the particle is a wavepacket, it must have certain widths in the spatial and temporal dimensions, Δx and Δt , which can be linked to the linewidths of the wave number and frequency by the following relations,

$$\Delta k \cdot \Delta x \sim 2\pi, \quad (31A)$$

$$\text{and } \Delta \omega \cdot \Delta t \sim 2\pi. \quad (31B)$$

Substituting Eqs. (18) and (19) into the above relations, we have

$$\Delta p \cdot \Delta x \sim h, \quad (32A)$$

$$\text{and } \Delta E \cdot \Delta t \sim h, \quad (32B)$$

Thus, one cannot simultaneously determine the values of position and momentum (or time and energy) of a free particle more precisely than what is described in Eqs. (32A) and (32B), which are basically the "Uncertainty principle" of Heisenberg.

page 11

5. "It implies a consistent geometrical relationship between mass, energy and momentum. In the study of theoretical physics, it is not uncommon to consider some of the physical relationships in term of geometry. We would like to explore if the result of our model makes good sense based on a geometrical consideration. Using the natural unit in which $c = 1$, the well established mass-energy relation (i.e., Eq. (26)) can be written as $E^2 = P^2 + m^2$ which appears as a geometrical relationship that E is the vector sum of two perpendicular vectors with amplitudes equal to p and m. (See Fig. 2a). Since m (or E) is a scalar instead of a vector, Eq. (39) cannot be regarded as a real vectorial relationship. Instead, it may suggest that m is associated with some sort of "intrinsic momentum" that characterizes the spatial variation of the wave function in directions orthogonal to p."

Conclusion

According to my evidence, rest mass is a real vector product of two perpendicular vectors of "c in linear direction, x c in 90 degree angular direction, creating a 90 degree arc trajectory, which if constant creates a circle, and a balance of centrifugal and centripetal forces. This is how "E" or energy = "m" or rest mass at (c^2)

In a more general sense, the use of c^2 as a balance of centrifugal and centripetal forces at 90 degree angel to each other, creating circular and or spherical motion and rest mass, carries over into the macro realm also. This is because it shows that the more general use of v^2 as a balance of centripetal and centrifugal force at 90 degree angle to each other, is about the simplest way to mathematically and geometrically describe circular motion. Just compare it with the other more complex ways of defining circular motion, and you will see yourself. It also quantifies the point in a vectorial relationship where two velocity vectors change from being additive to being multiplied, indicating a quantum leap in the mathematics that govern motion also which is when vectors are exactly equal and at 90 degree angular, but not before. And last but not least it show a relationship to the Pythagorean Theorem ($a^2 + b^2 = c^2$), which is used so much in physics to describe the energy, mass, velocity, relationship, among other things. In vector combining of speeds when vectors are exactly equal and 90 degree angular, but not before, $(a + b) = (a \times b) = c^2$
 $= (a^2 + b^2) = c^2$.

Now one can see that $(E=mc^2) = (F=mv^2)$ and (G), measured as $(L/T^2) = (c^2)$, which is the

ultimate (L/T^2) . And both = (c^{circled}) or $(cx2\pi)$ with angular momentum of $(h/2\pi)$.

If amplitude is constant or we start with circular polarized wave, it has angular momentum of $(h/2\pi/2)$, because wave makes two rotations at right angle to each other to complete one wave cycle with $(\text{spin } 1/2)$, making it a standing spherical wave.

In case where we might unify the constants we might say that:

$(c^2 = G = h/2\pi$ or more accurately $h/2\pi/2)$ and $(c = h = i = 2\pi = r$ or radius) as we can also see geometrically that just as $(r$ or radius $\times 2\pi =$ circumference of circle), $(c \times 2\pi) =$ wavelength with angular momentum of $(h/2\pi)$ which if it makes two rotations to complete one wave cycle or $(\text{spin } 1/2)$ will have angular momentum of $(h/2\pi/2)$.

According to http://en.wikipedia.org/wiki/Planck_units

If $G = c = h/2\pi = 1/4\pi\epsilon_0 = K_B = 1$ then $l_p = m_p = t_p = q_p = T_p = 1$ (non dimensionally)

According to this if $(c^2 = G = h/2\pi$ or more accurately $h/2\pi/2)$ and $(c = h = i = 2\pi = r$ or radius) then $E=mc^2 = m=E/c^2 = G=mc^2 = Q=E/c^2 = T = E/c^2 = t = E/c^2$ (dimensionally) or (geometrically)

Furthermore sense $E = m...$ then $Ec^2 = mc^2$ and sense $1 \times 1 = 1/1 = 1$ then $xc^2 = /c^2$. The use of $Ec^2, mc^2..$ and xc^2 or $/c^2$ is situational.

$E = m$, because of energy/mass equivalence. $E = m = G$, because of inertia mass/gravity mass equivalence. $E = m = G = Q$, because at the level of c^2 , particles with gravitational rest mass, generate charge, due to spin, and as these charges, increase or decrease, with distance. It might be considered $/c^2$, when weak, or xc^2 , when strong. $E = m = G = Q = T$, because of the space/energy equivalence, and the space/time equivalence. $E = m = G = Q = T = t$, because of the temperature/frequency equivalence. This introduces the new idea that matter is created, not by the cooling of temperature, as is commonly stated in cosmology, but in the raising of temperature to c^2 . Another prime example of when $/c^2$ is more appropriate than xc^2 , is in regard to temperature, which is mainly concerning frequencies which are divisions of c^2 , but may also involve temperatures xc^2 .

3 Reasons That $c = \sqrt{-1}$

1) First of all, quite simply because, $(c \times c)$, or c^2 , leads to a (-1 charged particle).

Our geometry produces a "standing spherical wave, making 2 rotations to complete 1 wave cycle, (spin 1/2), with angular momentum of $(h/2\pi/2)$ ". This directly matches "empirically"

measured, properties of "Electron", which is the natural unit quantum of -1 charge.

2) Second, because it matches the description referenced below:

An Imaginary Tale: The Story of the Square Root of -1

by Paul J. Nahin

page 53 paragraph 2:

“square root of -1 is directed line segment of **length 1 pointing straight up along the vertical axis**

or at long last, [$i = \sqrt{-1} = 1 \angle 90$ degree angle]. This is so important a statement that it is the only mathematical expression in the entire book that I have enclosed”

page 54 paragraph 2:

“multiplying by $\sqrt{-1}$ is geometrically, **simply a rotation by 90 degrees in the counterclockwise sense**

Because of this property square root of -1 is often said to be rotator operator, in addition to being an imaginary number.”

page 104 paragraph 2:

“In a revealing article criticizing Einstein's and Minkowski's, $c \times (\sqrt{-1})$, a national bureau of Standards physicist admitted that

Square root of -1 has a legitimate application in pure mathematic, where it forms a part of various ingenious devices for handling otherwise intractable situations”

3) And last but not least, because, (square root -1), works so well in solving, "otherwise intractable situations", in electronics problems, which involve electrons, Square root-1, must be intimately connected to the electron, which is the natural unit -1, and so c, must be the "natural unit" square root of "the natural unit -1", which is the electron itself.

If "c", in linear direction x "**c" pointing straight up in 90 degree angular direction, creates 90 degree counter clockwise rotation or arc**, and if this is also what creates the foundation for the backward spinning, standing spherical wave, such as electron of (-1 charge), than ($c = \sqrt{-1}$).

And last but not least, Einstein's and Minkowski's, ($ct \times \sqrt{-1}$) or ($c \times \sqrt{-1}$), as measure of quantum of space-time = ($E=mc^2$), as the cut off frequency counterpart, as waves cease to propagate at the inter granular space between substance that makes up the medium of propagation. So as EM waves cease to propagate at "c" in linear direction, because they attain rest mass at (c^2), which is c in circular and/or spherical rotation, than ($E=mc^2$) = the inter

granular space between rest mass particles = to $(ct \times \sqrt{-1})$, as quantum of space-time, postulated by Einstein and Minkowsky

Conclusion

And so if $[i = \sqrt{-1} = 1 \angle 90 \text{ degree angle}]$, than $[i = \sqrt{-1} = c \angle 90 \text{ degree angle}]$ (by convention $c=1$), and $(c = \text{sqrt } -1)$ in natural units.

But just as $(1 \times 1 = 1)$ in linear equations, and means something totally different in geometry, as $(1 \text{ unit in } x \text{ direction} \times 1 \text{ unit in } y \text{ direction} = 1 \text{ square unit})$, so $(c \times c)$ or (c^2) geometrically also leads to different results as explained above. And as the references agree, $(\text{the } \sqrt{-1})$, which cannot be derived by linear equations because there is no number that when multiplied by itself gives (-1) can be geometrically. And the "Uncertainty Principle" which states that "position and momentum cannot be measured at same time because numbers do not commute," and than no more accurately than $(h/2\pi i)$, may be transcended geometrically, because momentum is inversely proportional to wavelength, and both can be determined geometrically simultaneously, as both, "Donald C.Chang", and myself try to demonstrate

Furthermore, as gravity constant "G", is measured at (L/T^2) , (c^2) as the ultimate $(L/T^2 = G)$ on quantum level, as well as $(h/2\pi i)$, or more accurately $(h/2\pi i/2)$, and as (c^2) as geometrically a "frequency/wavelength", is precisely where energy attains rest mass, by acquiring circular and/or spherical rotation, such as standing spherical waves, and binding energy, according to this model.

$v^2 = c^2$, (which is the highest velocity squared), $c^2 = r^2$, because c in the linear direction and /or the 90 degree angular direction which creates the 90 degree arc, (which is foundation for circle) = radius of circle, and $c = h$ because c is constant speed of light which gives it its constant kinetic energy/mass of h .

Therefore $(E=hf/c^2)$, the equation for quantum energy/ mass = $(F=mm/r^2)$, Newtons equation for gravity, minus the big G , sense h is its own constant, and $(F=mv^2)$, the equation of force or energy of mass in motion = $(E=mc^2)$, the equation for energy/mass equivalence, on the quantum level and $(a=v^2/r) = (a=c^2/c)$. And so the same force that compresses energy into rest mass particles at $(E=hf/c^2) = (E=mc^2)$ pushes rest mass particles together at $(F=mv/r^2) = (F=Gmm/r^2)$. They are equivalent at quantum level and directly proportional at macro level.

Latest Evidence

Scientists in Sweden film moving electron for the first time. It resembles a elongated standing spherical wave, rotating about two axis, fitting description which I have geometrically demonstrated, as opposed to a point particle or probability wave.

Latest evidence on geometrical structure of electron from site: <http://www.youtube.com/watch?v=ofp-OHIq6Wo&feature=related>

Final Conclusion

In light of this evidence, the Planck unites are recalculated, and the long sort (Quantum Gravity), is revealed to have been right under our noses all the time. All it took was for the most famous equation in the world ($E=mc^2$), by the most famous scientist, "Albert Einstein", be reinterpreted geometrically. In light of this ($G = h/2\pi i = c^2$) and ($c = h = i = 2\pi i = r$ or electron radius), which unifies General, Special Relativity and Quantum Theory demystifying "Quantum Gravity", "The Uncertainty Principle" and taking "sqrt-1", out of imaginary realm into the real realm of natural unites. All the natural constants seem to revolve around c (speed of light), and this may prove to be an axiom of physics also.

The way all this evidence came so smoothly together cannot be just coincidence, as the more coincidences involved, the more probable that it is correct. And this is just one more mathematical support for this idea, a statistical one. In other words, the more coincidences there are - the more likely it is not just a coincidence but actually fact. Ultimately from this we may even be able to bypass the photo electric effect, creating electrons more directly by getting sunlight to pass through a strong enough field of some sort which increases there mass from $E=hf$ to $E=mc^2$.

More References:

<http://www.colorado.edu/physics/2000/quantumzone/debroglie.html>

["http://en.wikipedia.org/wiki/De_Broglie_hypothesis](http://en.wikipedia.org/wiki/De_Broglie_hypothesis)

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<http://www.mathpages.com/home/kmath633/kmath633.htm>

<http://www.youtube.com/watch?v=ofp-OHIq6Wo&feature=related>

http://en.wikipedia.org/wiki/De_Broglie_hypothesis

"The **de Broglie relations** show that the wavelength is inversely proportional to the momentum of a particle"

An Imaginary Tale: The Story of the Square Root of -1

by Paul J. Nahin

page 53 paragraph 2:, page 54 paragraph 2:, page 104 paragraph 2:

Six Easy Pieces: Richard Feynman page 129 paragraph 3

[arXiv:physics/0505010](https://arxiv.org/abs/physics/0505010) [pdf]

Title: On the wave nature of matter

Authors: [Donald C. Chang](#)

[arXiv:physics/0404044](https://arxiv.org/abs/physics/0404044) [pdf]

Title: What is rest mass in the wave-particle duality? A proposed model

Authors: [Donald C. Chang](#)

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P.S. Interesting Observation

According to: Symmetry and the Beautiful Universe

by Leon M. Lederman "Nobel Laureate"

and Christopher T. Hill

Chapter 10

Quantum Mechanics

Section The wave function

p 218 pp 3,4,5

"The quantum wave function, however, has values for its amplitude that are things called complex numbers. For a given wave we would say that at a particular point in space, the quantum wave has an amplitude of $3+5i$, where $i = \sqrt{-1}$; that is, i is the number that, when multiplied by itself, gives -1 . Numbers that are real plus (real times i) are complex numbers. These

would have really depressed Pythagoras. In fact Schrodinger's wave equation itself always involves $i = \sqrt{-1}$ in a fundamental way, and this is what forces the wave function to be a complex number. This mathematical twist in the road to the quantum theory is inescapable. This strongly hints that we can never directly measure the wave function of of a quantum mechanic

particle, since we can only measure, in experiment, things that are always real numbers. The question of the wave function thus loomed larger than ever. An accomplished German physicist, Max Born, supplied the answer. Born who worked in the 1920s with Wolfgang Pauli and Werner Heisenberg at university of Göttingen, at the same time as Emmy Noether's residence there, provided a physical interpretation of the wave function that has both empowered and haunted quantum mechanics ever since. Born, strongly influenced by Heisenberg's uncertainty principle, proposed that the (absolute) square of the wave function, which is always a real and positive number, is the probability of finding the particle at any given point in space at any particular time. $|\psi(\vec{x}, t)|^2$ is probability of finding particle at position \vec{x} at the time t . Born's interpretation of Schrodinger's wave function thus locks together, inextricably, the notion of a particle to the notion of a wave."

Interesting Conclusion

In the Geometrical Interpretation of $(E=mc^2) = (E=mc^{\text{circled}})$ and $(c = i)$, i is a real natural unit = to c , and the square of the wave function = c^2 , and so it is no longer a mystery why a wave function containing i , which is smoothed out by squaring it, works in measuring the position of a particle, at a particular time, in the wave, because i , is a natural component of the wave function, and the square of the wave function is = to c^2 , and exactly equals what it takes to turn a wave into a particle.
