Quantum-Entangled Superluminal Double-Helix Photon Produces a Relativistic Superluminal Quantum-Vortex Zitterbewegung Electron and Positron

Richard Gauthier
Department of Chemistry and Physics
Santa Rosa Junior College
Santa Rosa, California, USA
https://richardgauthier.academia.edu/research

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The Double-Helix Photon Model

The double-helix photon model is composed of two oppositely charged superluminal energy quantum particles moving in a double-helical trajectory.

The energy quanta are held in the double-helical trajectory by the Coulomb attractive force between the two superluminal energy quanta of electric charge Q and -Q separated by the helical diameter D.

Equations for the two half-photons in the double-helix photon model

$$x_1(t) = \frac{\lambda}{2\pi}\cos(\omega t)$$

$$y_1(t) = \frac{\lambda}{2\pi}\sin(\omega t)$$

$$z_1(t) = ct$$

$$p_{x1}(t) = -\frac{h}{2\lambda}\sin(\omega t)$$

$$p_{y1}(t) = \frac{h}{2\lambda}\cos(\omega t)$$

$$p_{z1}(t) = \frac{h}{2\lambda}$$

$$x_2(t) = -\frac{\lambda}{2\pi}\cos(\omega t)$$

$$y_2(t) = -\frac{\lambda}{2\pi}\sin(\omega t)$$

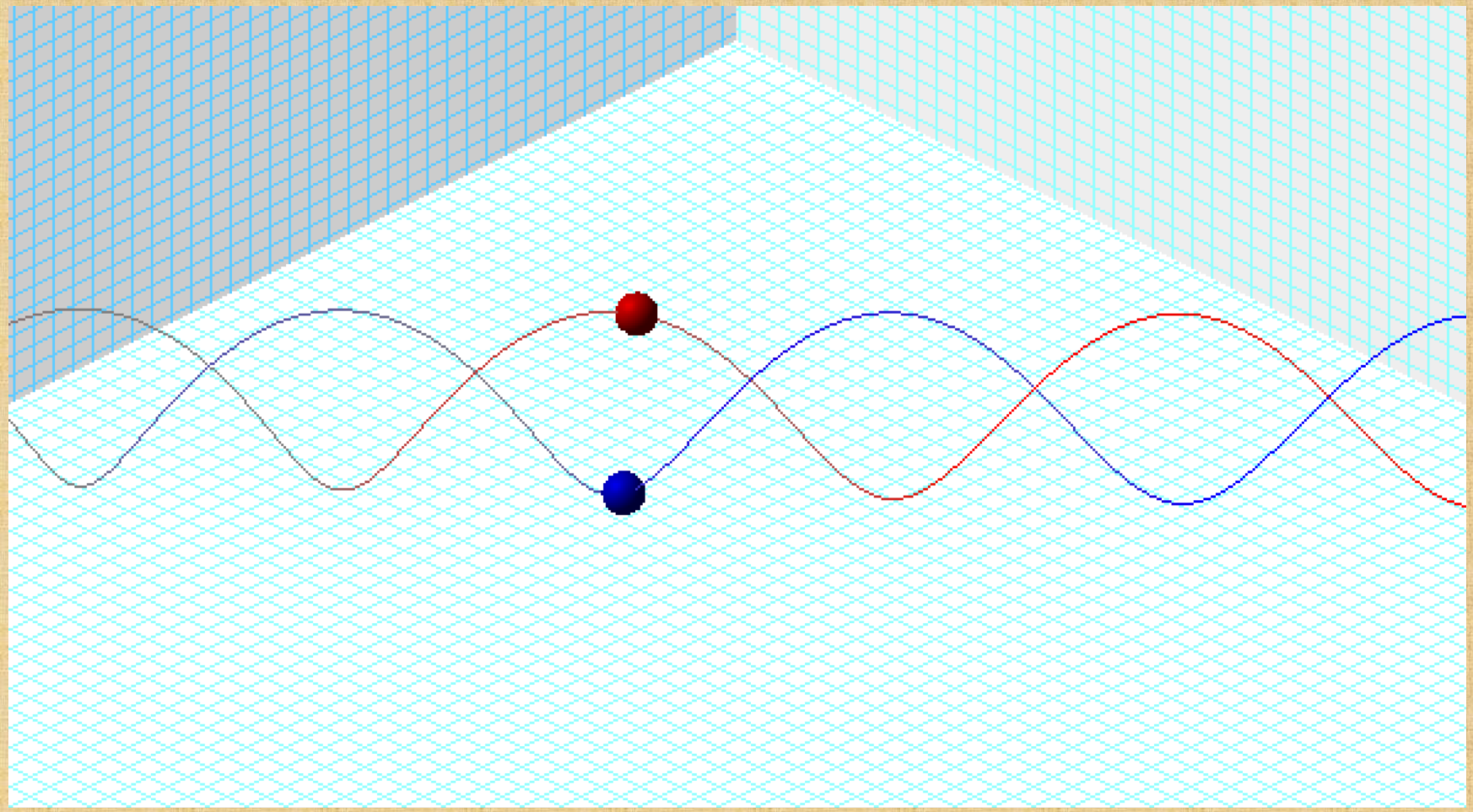
$$z_2(t) = ct$$

$$p_{x2}(t) = \frac{h}{2\lambda}\sin(\omega t)$$

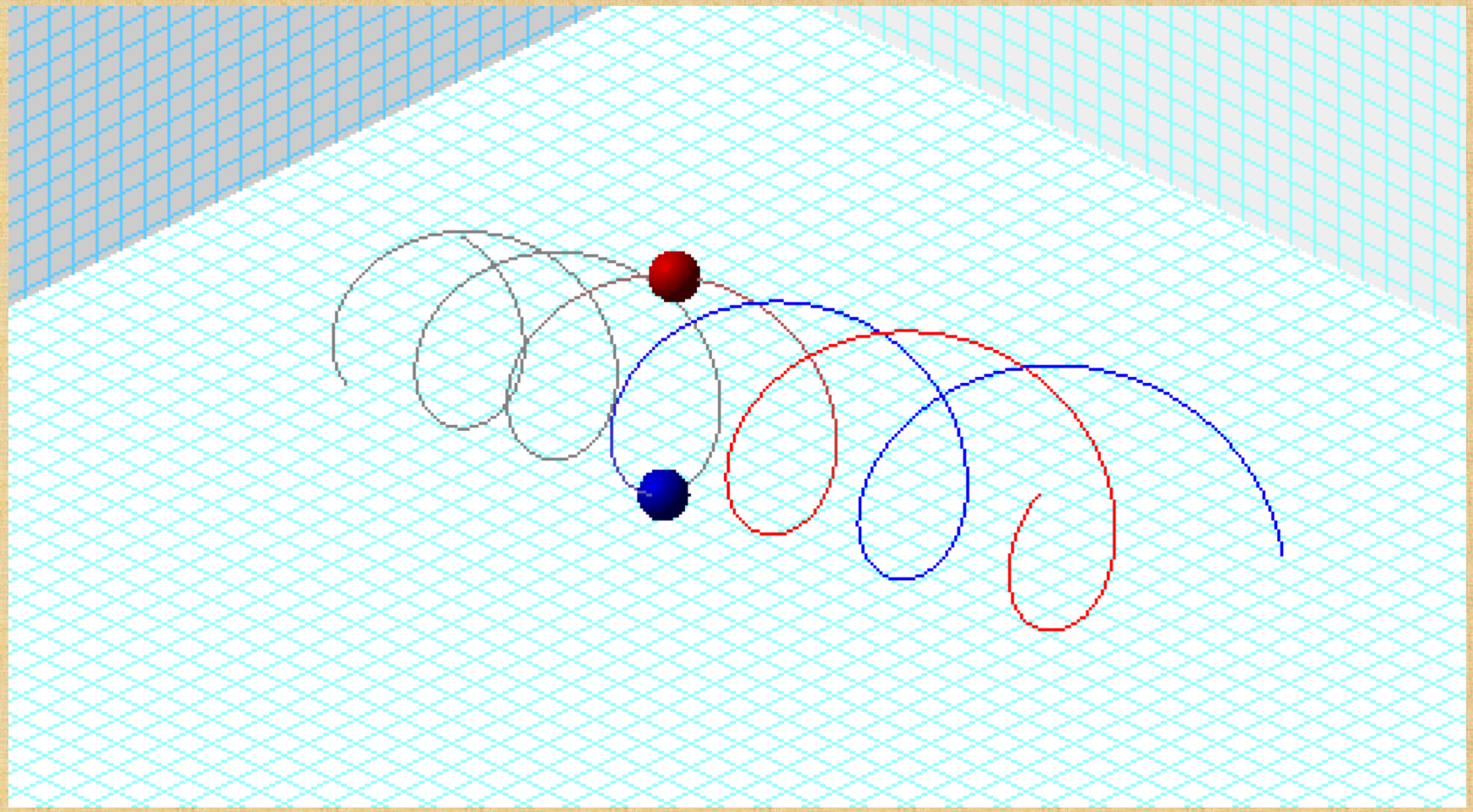
$$p_{y2}(t) = -\frac{h}{2\lambda}\cos(\omega t)$$

$$p_{z2}(t) = \frac{h}{2\lambda}$$

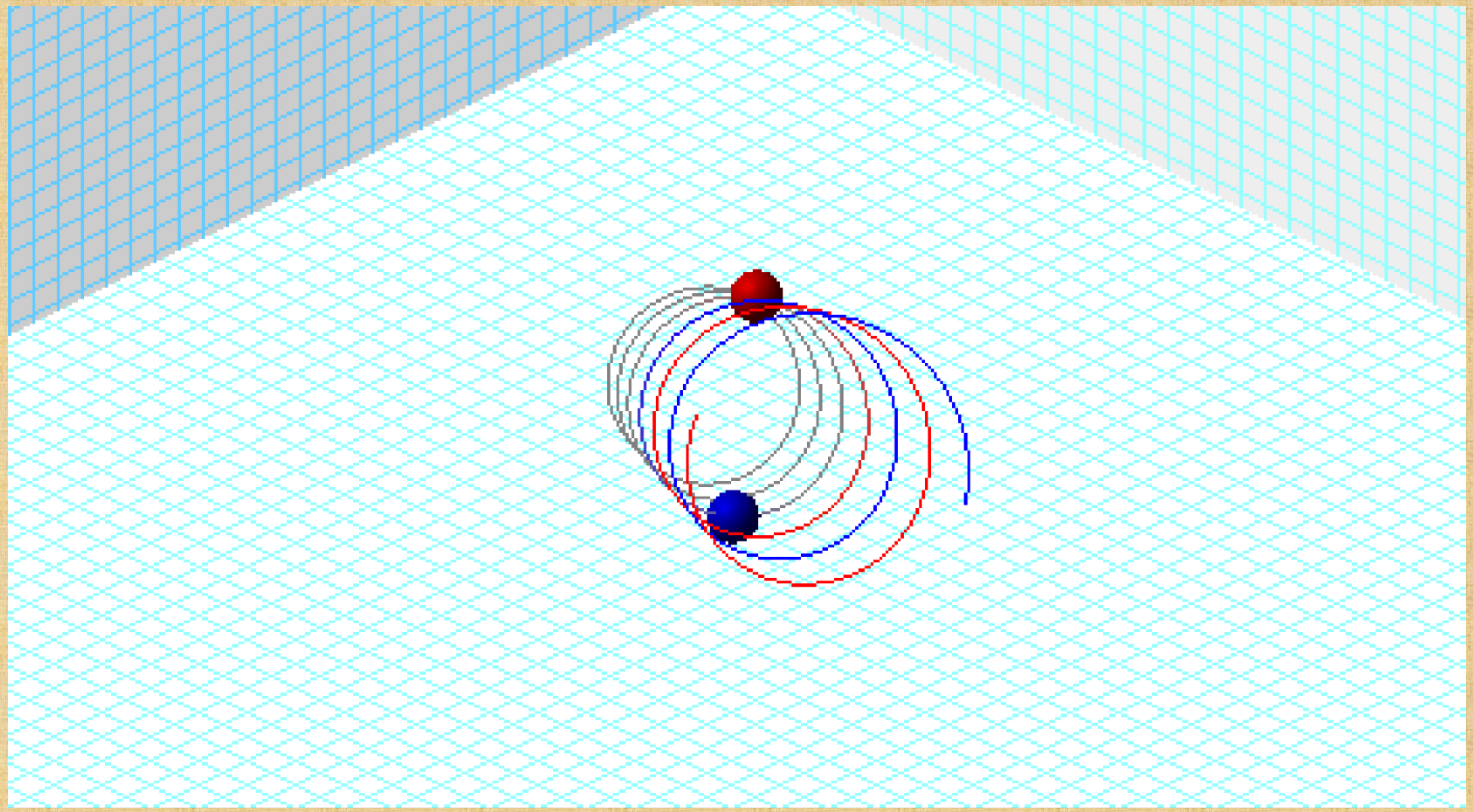
Double helix photon model, side view



Double helix photon model, angular view



Double helix photon model, end view



Properties of the superluminal double-helix photon model generating the relativistic quantum-vortex electron model

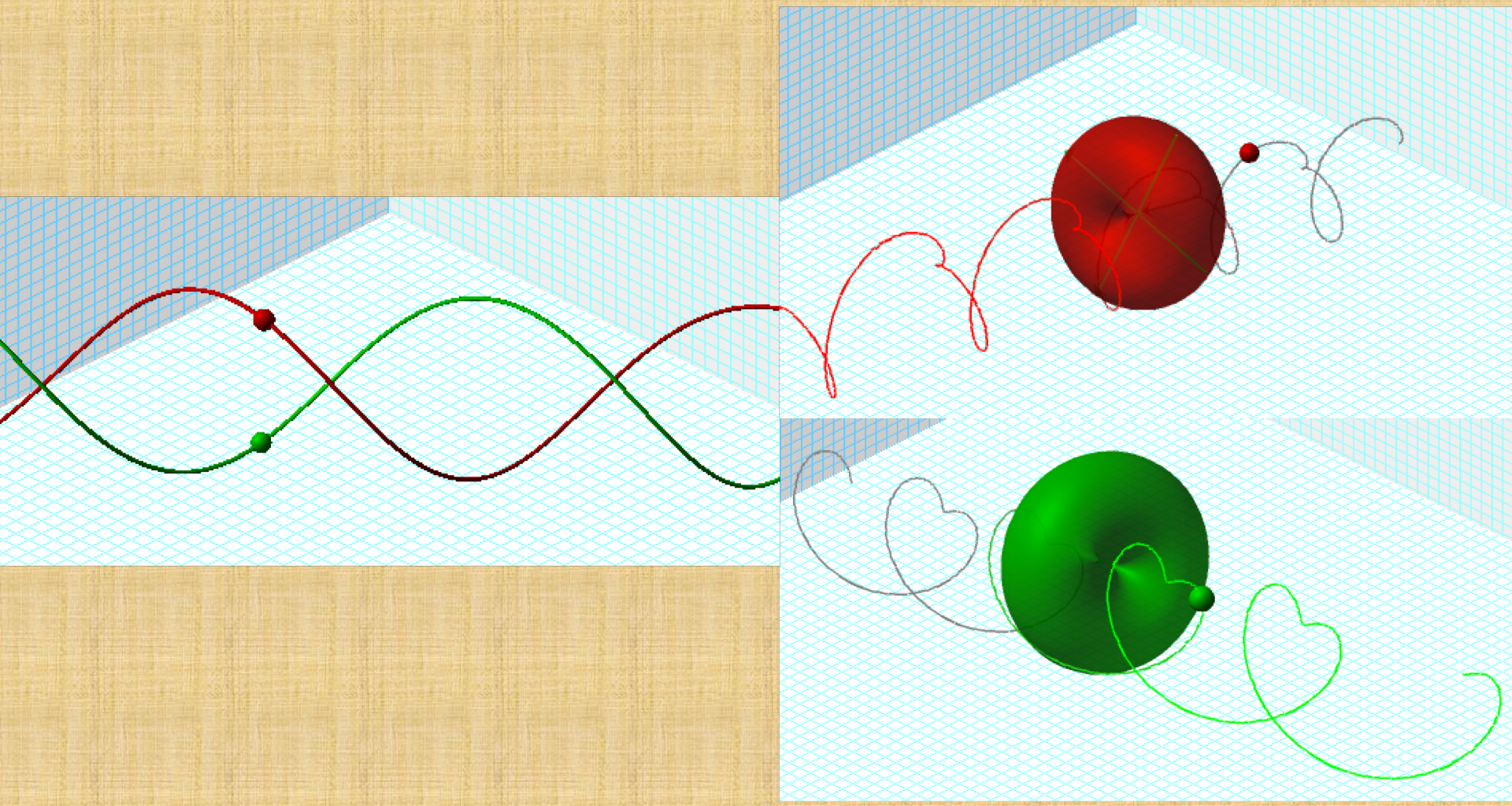
1. The photon model is composed of two electrically-charged half-photons in double-helical motion where the forward speed of the model is *c*.
2. The dipole charges are $Q = \pm e\sqrt{2/\alpha} = \pm 16.6e$ where $\alpha = 1/137.04$ is the fine structure constant.
3. The speed of each superluminal energy quantum is $v = c\sqrt{2} = 1.414c$.
4. The angle of each helical trajectory is 45 degrees.
5. The distance between the two dipole charges is $D = \lambda/\pi$.
6. The total energy of the photon model is $E = h\nu$.
7. The total momentum is $p = h\nu/c = h/\lambda$.
8. The total spin is $S = \pm 1\hbar$.
9. The electrical potential energy of the charge dipole is $U = -E$.
10. The half-photons composing the photon model are proposed to be quantum-mechanically entangled.

Electron-positron pair production from the double-helix photon model

The double-helix photon model suggests a mechanism for electron-positron pair production.

In the presence of an atomic nucleus, the two charged superluminal quanta of a sufficiently energetic photon reduce their electric charge and are thrown off as an electron of charge $-e$ and a and a positron of charge $+e$.

Electron-positron pair production from double-helix photon model



Equations of the relativistic superluminal half-photon quantum-vortex positron and electron models

$$x(t) = \frac{\lambda_C}{4\pi}\left(\frac{1}{\gamma^2} + \frac{1}{\gamma}\cos(\gamma\omega_{zitt}t)\right)\cos(\gamma\omega_{zitt}t)$$

$$y(t) = \frac{\lambda_C}{4\pi}\left(\frac{1}{\gamma^2} + \frac{1}{\gamma}\cos(\gamma\omega_{zitt}t)\right)\sin(\gamma\omega_{zitt}t)$$

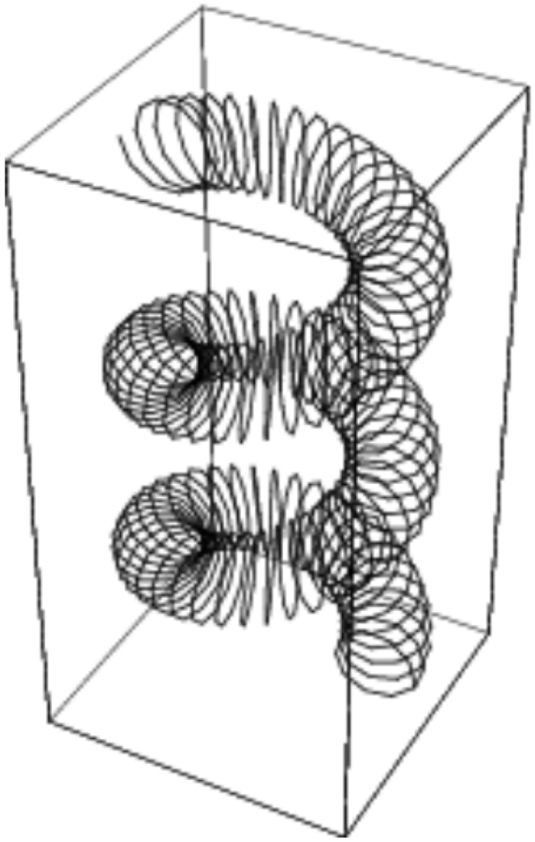
$$z(t) = \mp\frac{\lambda_C}{4\pi\gamma}\sin(\gamma\omega_{zitt}t) + Vt$$

where $\lambda_C = h/mc = 2.43\times10^{-12}\,\mathrm{m}$ is the Compton wavelength.

$\lambda_C / 4\pi$ is the radius of a double-helix photon of energy equal to the rest energies of an electron plus a positron, and is also the helical radius of the electron model.

$\omega_{zitt} = 2\pi v_{zitt} = 2mc^2/\hbar$ is the electron's zitterbewegung angular frequency from the Dirac equation.

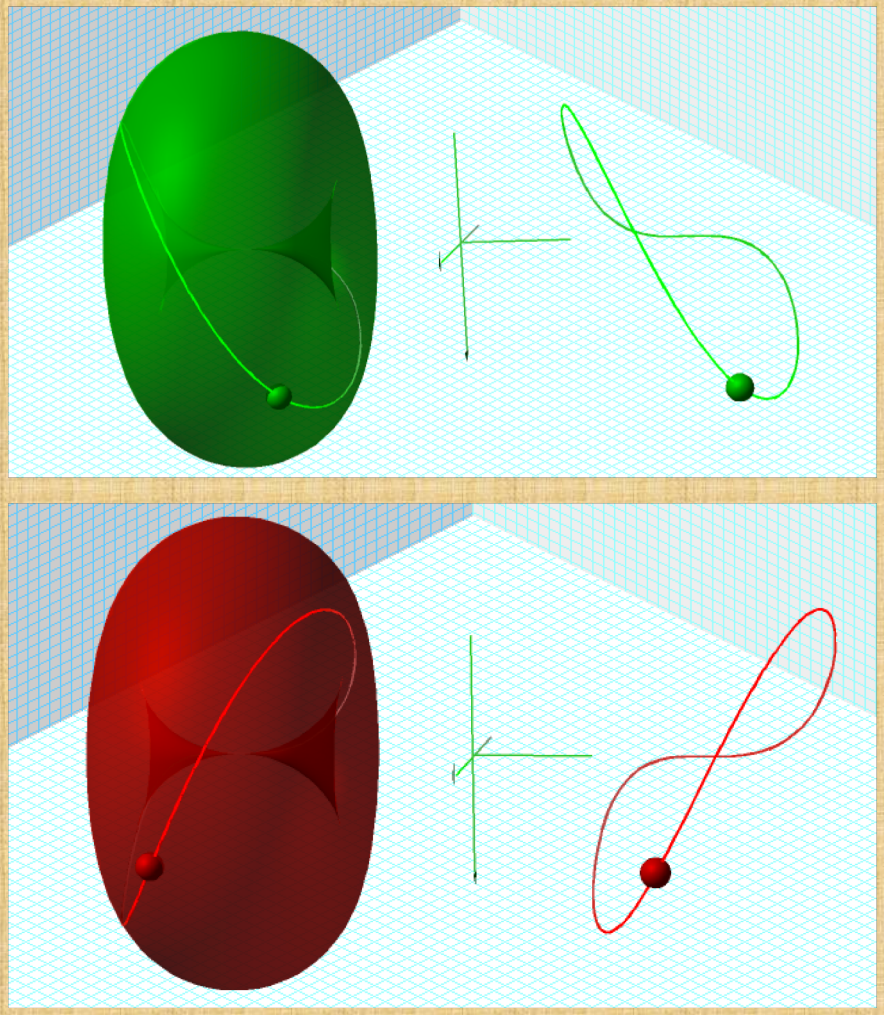
The equations for the relativistic electron and positron models have the same form as the equations for a Slinky



http://mathworld.wolfram.com/Slinky.html

$$x(t) = [R + a\cos(\omega t)]\cos t$$
$$y(t) = [R + a\cos(\omega t)]\sin t$$
$$z(t) = a\sin(\omega t) + ht$$

Superluminal spin +½ half-photon quantum-vortex resting or slowly-moving electron and positron models formed from spin-½ charged half-photon model. The superluminal quantum moves on the surface of a mathematical horn torus.



Equations of the highly relativistic superluminal half-photon quantum-vortex positron and electron models

$$x(t) = \frac{R_o}{2\gamma} + \frac{R_o}{2\gamma}\cos 2\gamma\omega_{zitt}t$$

$$y(t) = \frac{R_o}{2\gamma}\sin 2\gamma\omega_{zitt}t$$

$$z(t) = \mp\frac{R_o}{\gamma}\sin\gamma\omega_{zitt}t + Vt$$

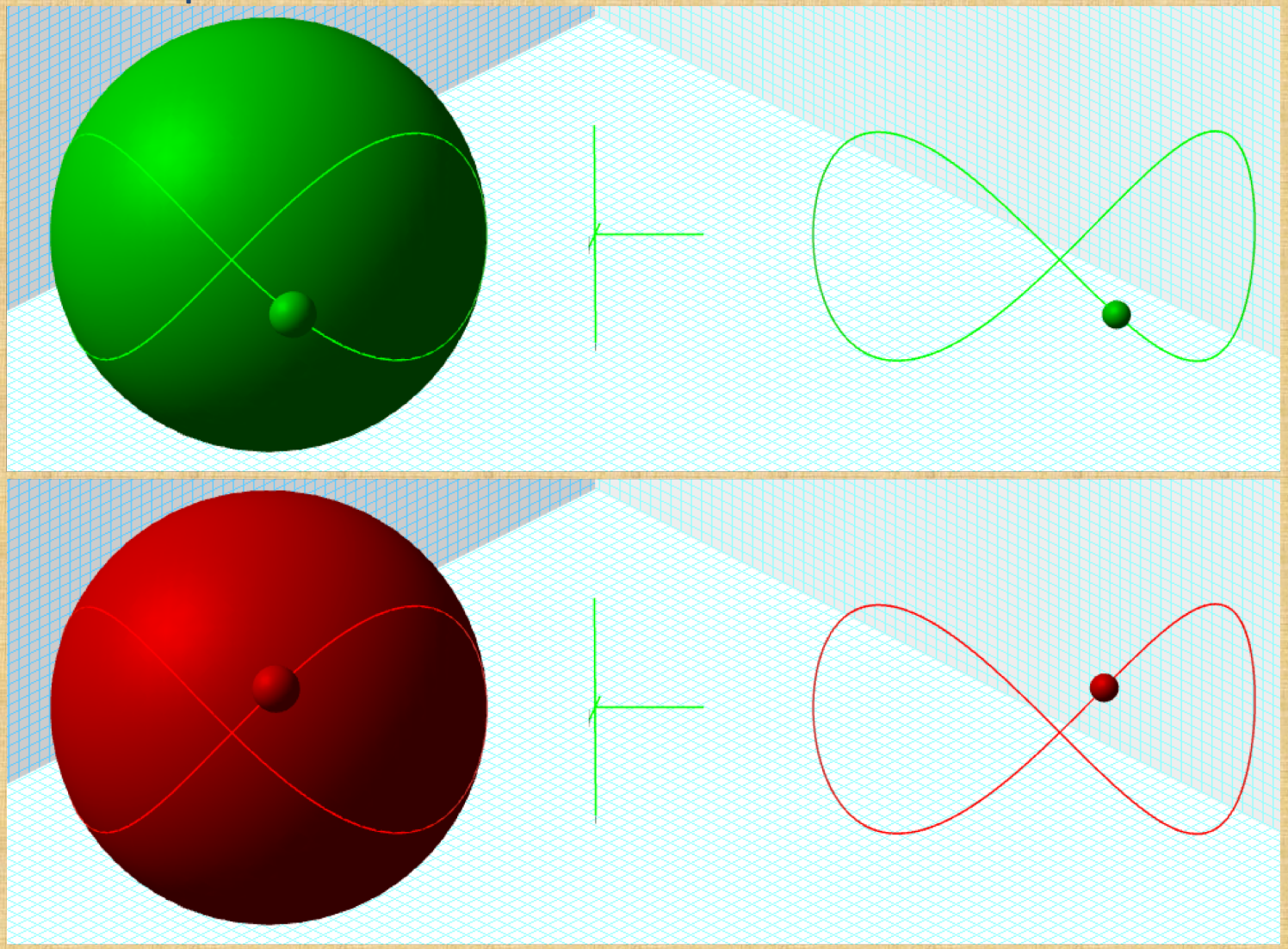
$$v_x(t) = -c\sin 2\gamma\omega_{zitt}t$$

$$v_y(t) = c\cos 2\gamma\omega_{zitt}t$$

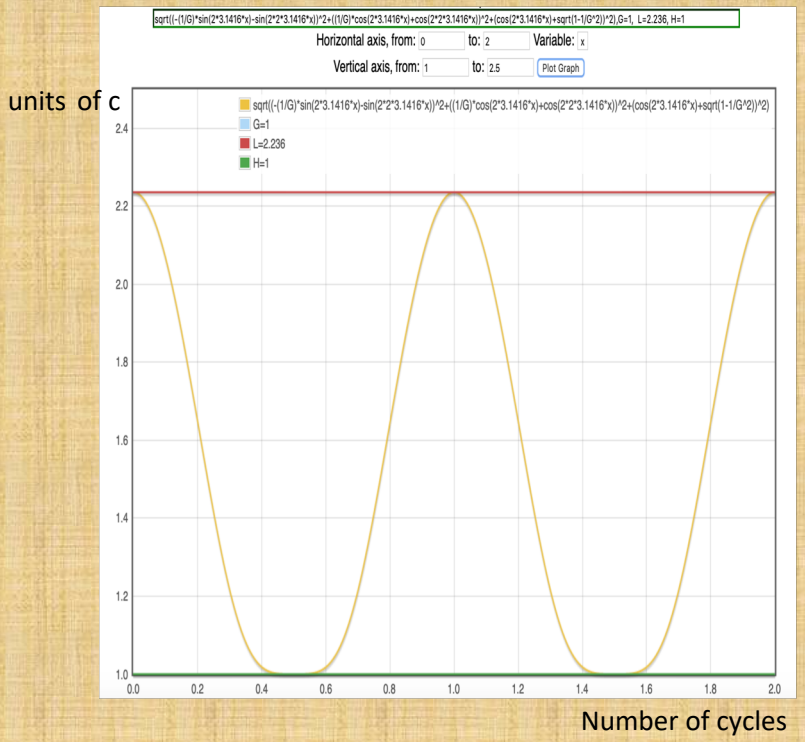
$$v_z(t) = \mp c\cos\gamma\omega_{zitt}t + V$$

$R_o = \lambda_C / 4\pi$, while $\omega_{zitt} = 2\pi\nu_{zitt} = 2mc^2/\hbar$ is the electron's zitterbewegung angular frequency. *V* is the velocity of the electron model. Note that the size of the positron and electron models decrease as 1/gamma, while the internal velocity components remain proportion to *c* for any value of gamma.

Highly relativistic superluminal spin-½ half-photon quantum-vortex positron and electron models formed from spin-½ charged half-photon model. The superluminal quantum moves on the surface of a mathematical sphere that moves with the electron model's velocity *V*.



These figures show the speed of the superluminal energy quantum over two internal cycles in a resting electron model and in a highly relativistic (gamma=1000) electron model.



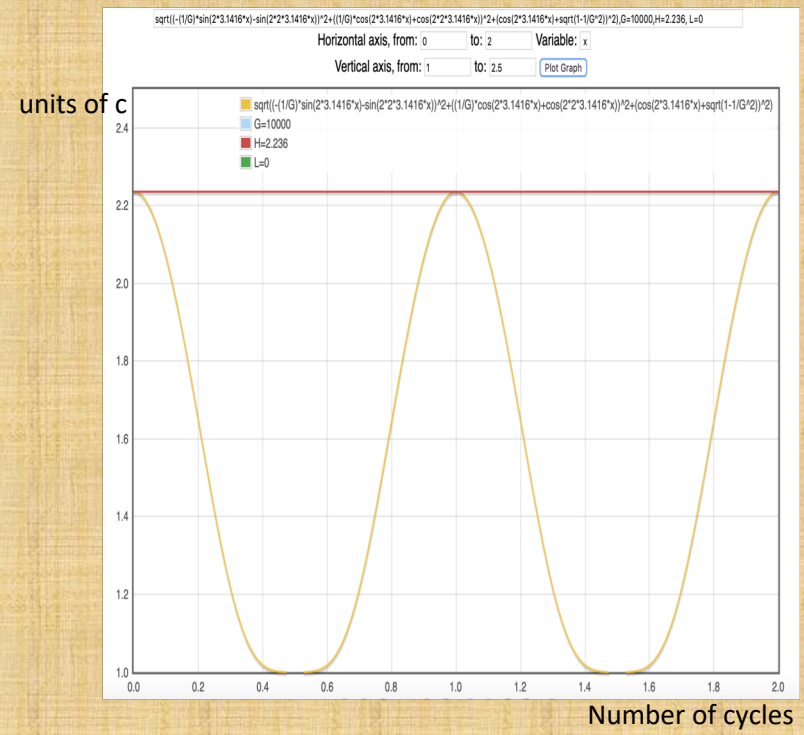


Figure 1 . In both cases, the minimum speed of the superluminal energy quantum is v=c and the maximum speed is v=c sqrt(5) = 2.236c. This is also the case for the positron model. The graphs are virtually identical.

These graphs show the speeds of the superluminal energy quantum over two cycles for the negative-turning spin+1/2 electron and positive-turning spin +1/2 positron respectively when the electron model's speed is given by gamma = c sqrt(2)=1.414c

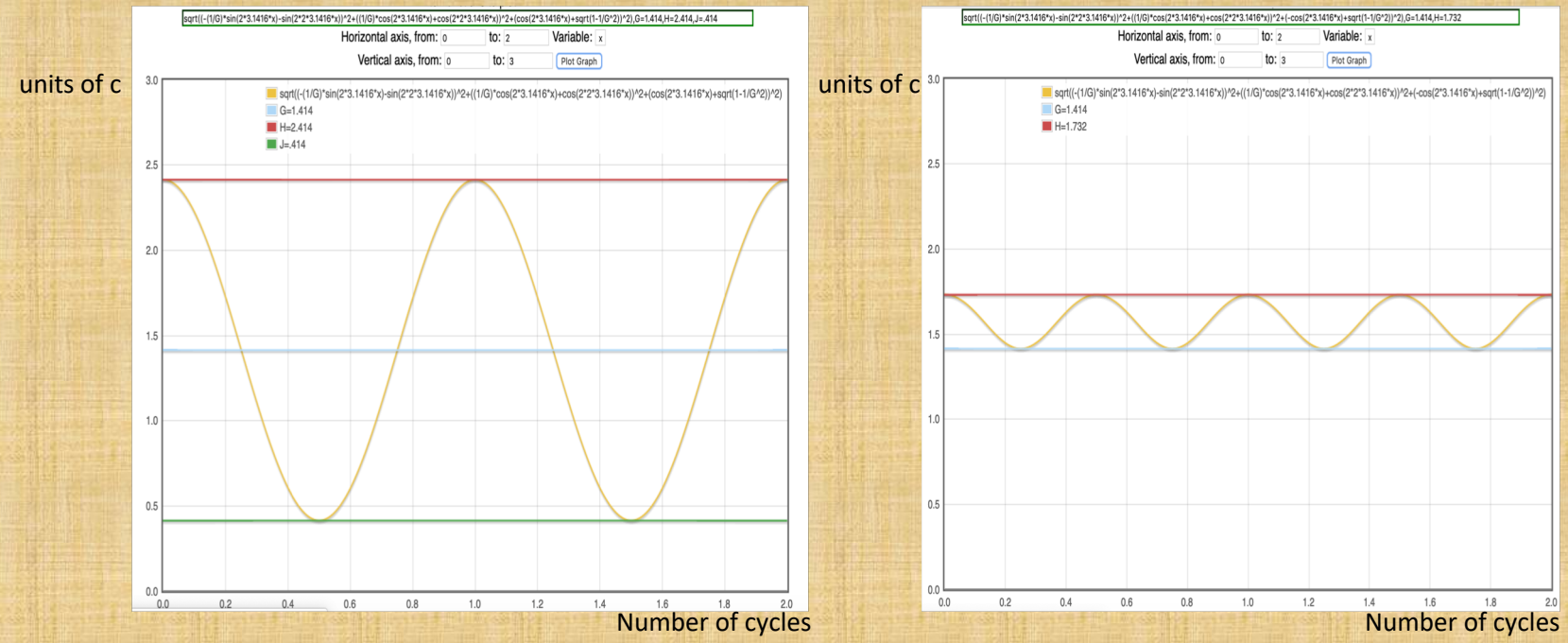


Figure 2. In the figure on the left (spin +1/2 electron), the speed of the superluminal energy quantum ranges from 0.414 c to 2.414c, passing through c twice per cycle. In the figure on the right (spin +½ positron), the speed of the superluminal energy quantum ranges from csqrt(2) =1.414 c to c sqrt(3) = 1.732c. The two figures are switched for the spin -1/2 electron and the spin -1/2 positron models.

These figures show the speed of the superluminal energy quantum over two cycles in a highly relativistic spin +1/2 electron model and in a highly relativistic spin +1/2 positron model.

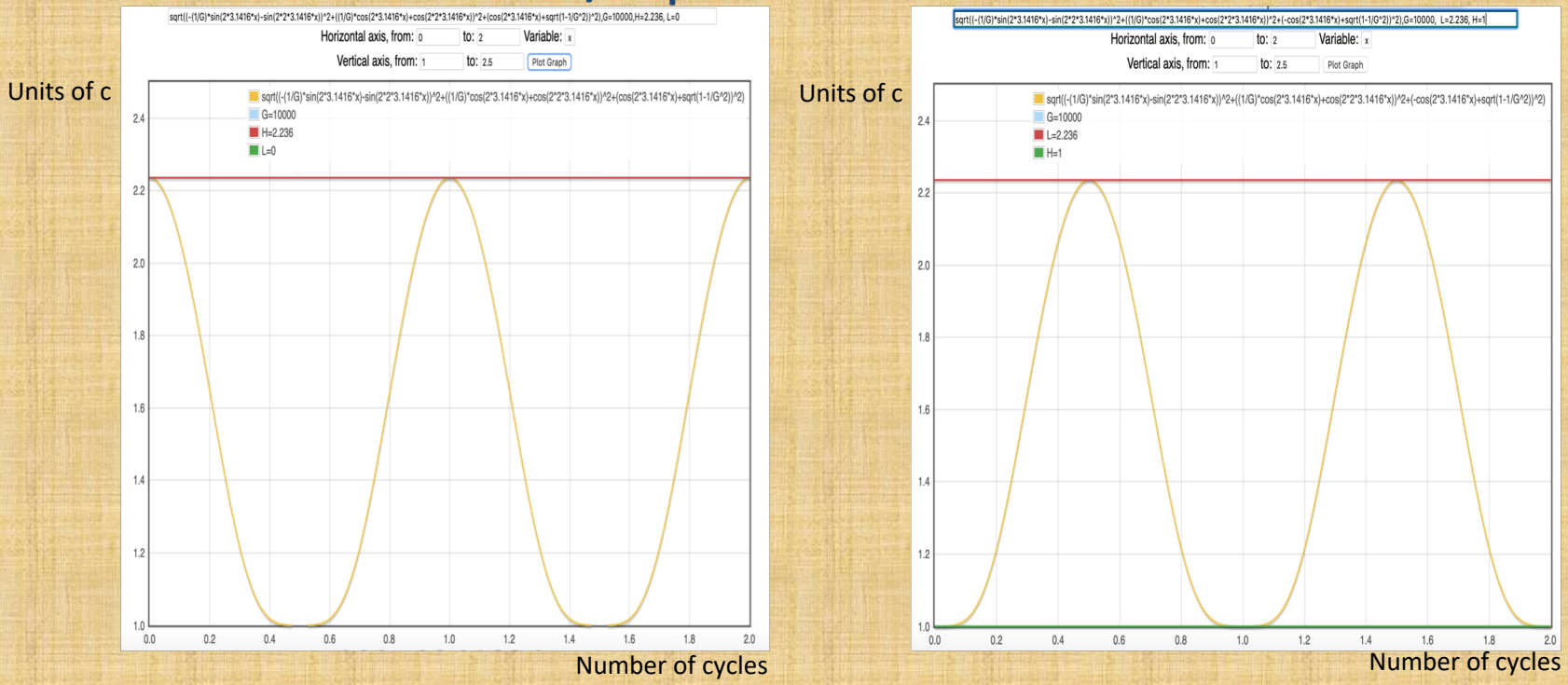


Figure 3 . The electron model is on the left and the positron model is on the right. Gamma = 1000 for both the electron and the positron models. In both cases, the minimum speed of the superluminal energy quantum is c and the maximum speed is c sqrt(5) = 2.236c. But the graphs for the electron and the positron model are 180 degrees out of phase.

This graph shows how the maximum internal speed of the superluminal energy quantum of the left-handed spin +1/2 electron model varies as a function of gamma of the electron, reaching its maximum speed sqrt(2)+1=2.414c when gamma = sqrt(2).

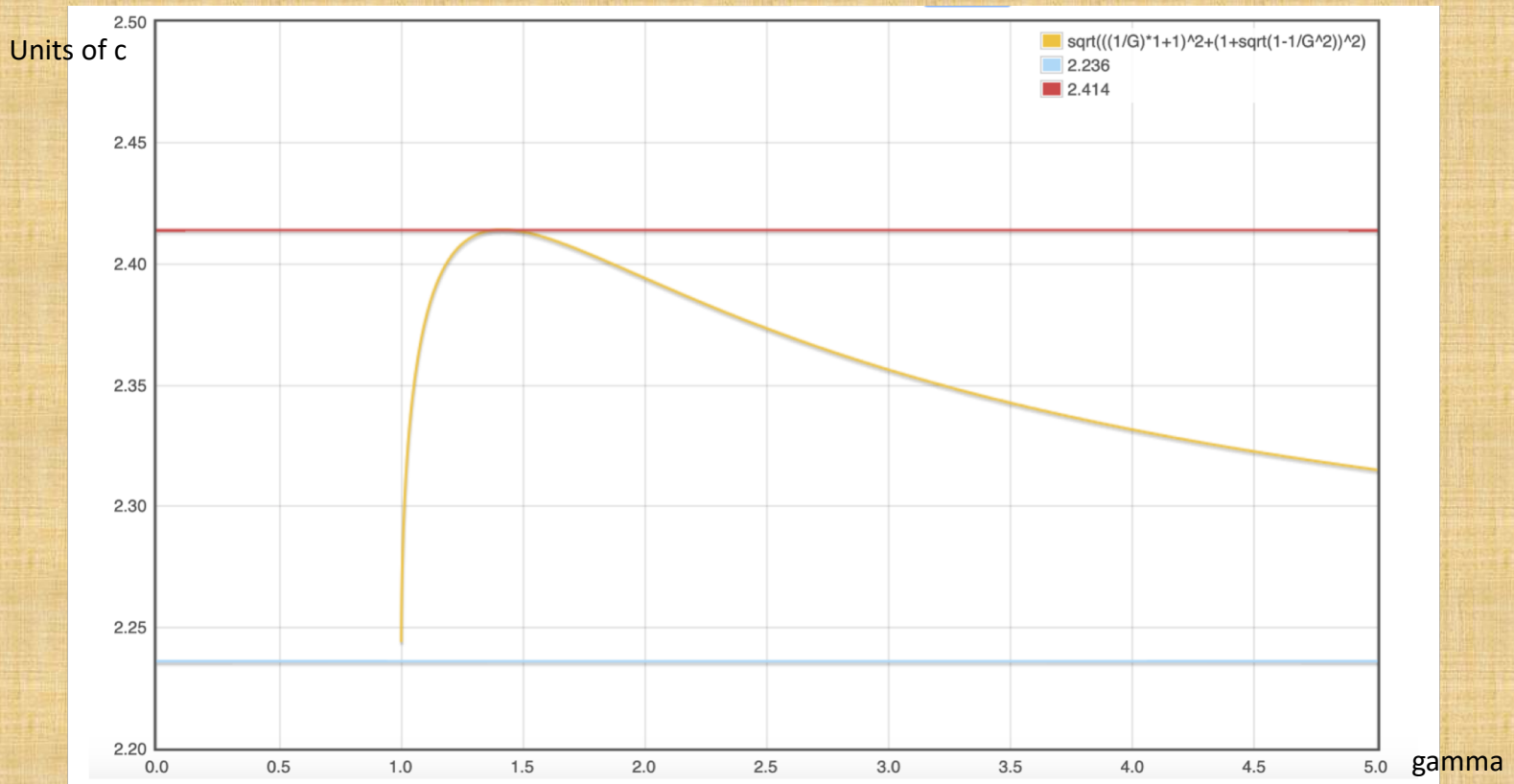


Figure 4. Showing the value of v_{max} (in units of c) of the superluminal energy quantum in the quantum vortex electron model as a function of γ of the left-handed spin +½ electron model. The curve has a maximum of $v_{max} = c(\sqrt{2}+1) = 2.414c$ at $\gamma = \sqrt{2}$ and a minimum of $v\min = c\sqrt{5} = 2.236c$ at $\gamma = 1$ and as $\gamma \to \infty$.

This graph shows how the minimum internal speed of the superluminal energy quantum of the left-handed spin-up electron model varies as a function of gamma. The circulating quantum reaches its minimum speed c(sqrt(2)-1)=0.414c when gamma = sqrt(2)=1.414.

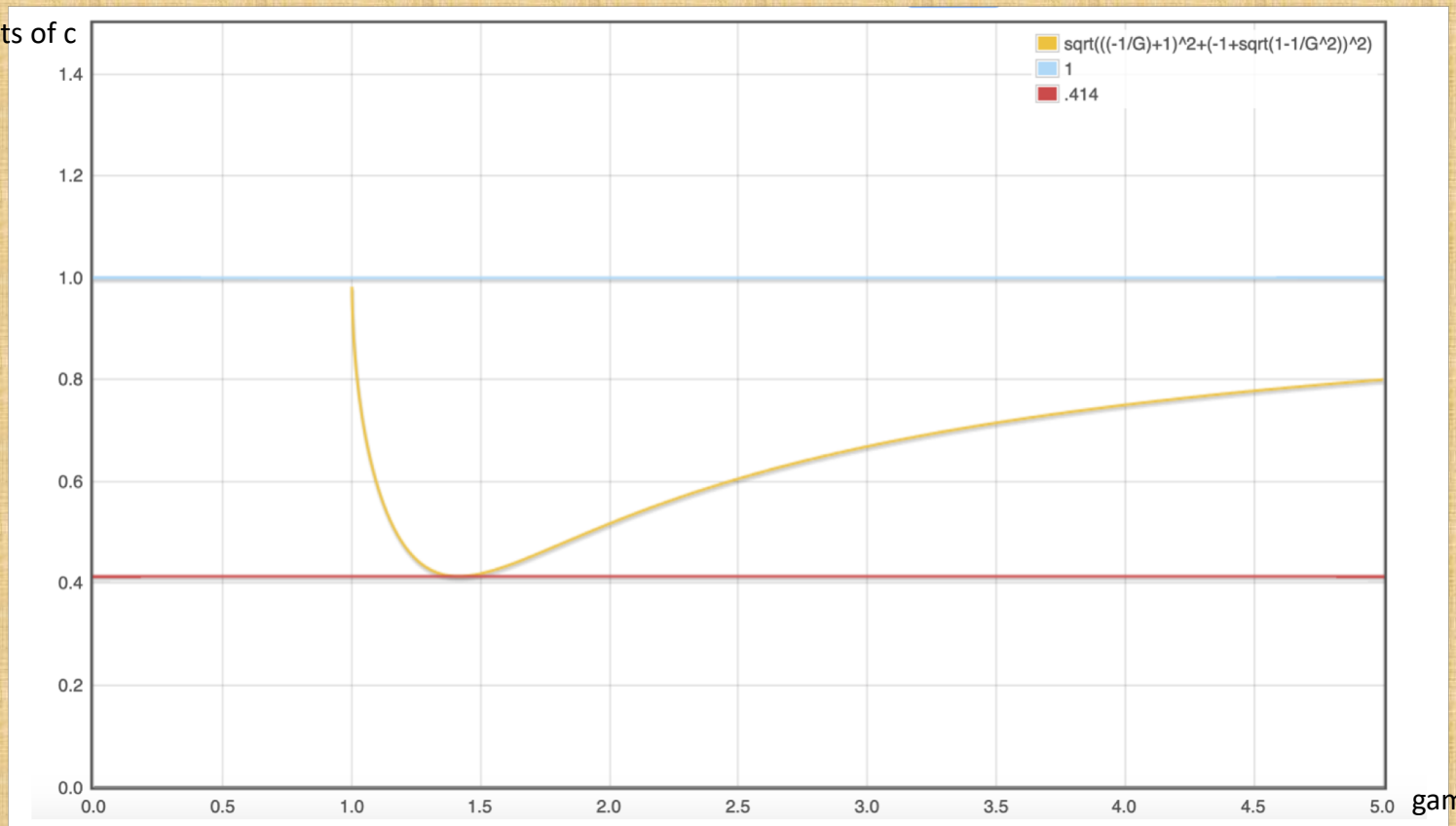


Figure 5. Showing the value of v_{min} (in units of c) of the superluminal energy quantum in the left-handed quantum vortex electron model as a function of γ of the electron model. The graph has a minimum value of $v_{min} = c(\sqrt{2}-1) = 0.414c$ at $\gamma = \sqrt{2} = 1.414$ and a maximum value of $v_{min} = c$ at $\gamma = 1$ and as $\gamma \to \infty$.

Experimental tests of double-helix photon model and quantum vortex electron and positron models

The predicted charges Q and $-Q$ provide a strong experimental test of the composite photon model.

Close analysis of electron-positron pair production could show how the charge magnitude $Q = 16.6\ e$ of each superluminal quantum in the double helix photon model becomes the charge magnitude $q = 1\ e$ of the electron and the positron. This would be strong experimental evidence for the double-helix photon model.

Look for evidence of superluminality within the electron and positron, and for differences in this superluminality for different electron and positron spins.