The Electrostatic Force

Preston Guynn
Guynn Engineering, 1776 Heritage Center Drive, Suite 204
Wake Forest, North Carolina, United States 27587
guynnengineering@gmail.com

In our previous paper, *Electromagnetic Effects and Structure of Particles due to Special Relativity*, we proved that electromagnetic effects are due to special relativity. We also proved that particle structure is due to special relativity and derived the structure of electron and proton. In addition, we developed a framework for interaction between charged particles and photons. In this paper we extend that work with additional insights into the electrostatic force.

Introduction

Because time dilation occurs only in the direction of motion, and not in the transverse direction, angular rotation, ω, results in angular precession, ω_P, according to[1]

$$\omega_P = \omega(\gamma - 1) \tag{1}$$

where γ is the Lorentz factor. The sense of precession is of rotation in the opposite direction of the original angular rotation. Angular rotation minus angular precession gives a difference angular velocity

$$\omega_d = \omega - \omega_P = \omega(2 - \gamma) \tag{2}$$

This can be thought of as effective angular velocity. Multiplying by radius, we can write difference velocity in terms of rotation velocity.

$$v_d = v(2 - \gamma) \tag{3}$$

Figure 1 shows difference velocity graphed from Equation 3.

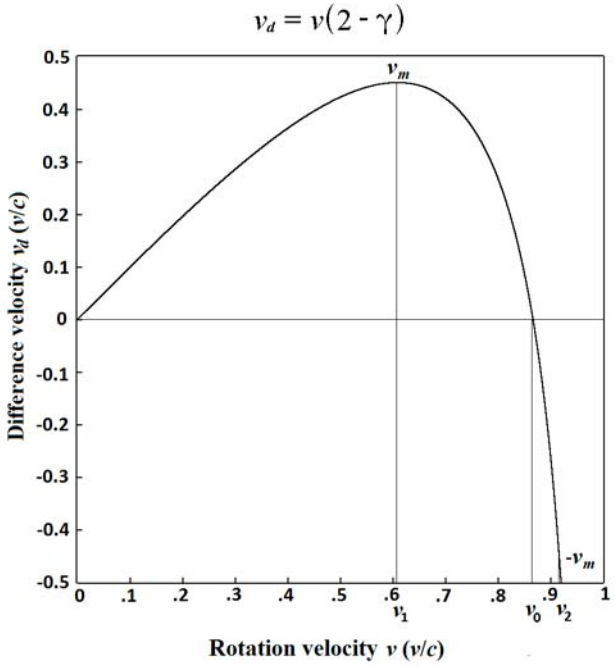


Fig 1. Difference velocity with electron range annotated.

When we solve for the maximum difference velocity we find

$$v_m = (2^{2/3}\text{-}1)^{3/2}\, c \;\cong 134965504.63776 \text{ m/s}, \tag{4}$$

where c is the speed of light.

Analysis

In order to find the maximum difference angular velocity of the electron, we use the electron radius which was derived in our previous paper[2]. $R_e \cong 1.28663582937643\text{e}10^{-12}$ m. The electron maximum difference angular velocity can be written as

$$\omega_m = v_m / R_e \cong 1.048979839953 * 10^{20} \tag{5}$$

The maximum difference angular velocity of the proton can be derived using the proton maximum difference velocity and proton radius derived in our previous paper[2]. Proton maximum difference velocity is $v_{mp} \cong 3149694.18144$, and proton radius is $R_p \cong 3.00262603862772\text{e}10^{-14}$

$$\omega_{mp} = v_{mp} / R_p \;\cong 1.048979839953 * 10^{20} \tag{6}$$

These two maximum difference angular velocities are equal, such that an electron and proton when at their maximum difference angular velocity are synchronous.

The kinetic energy of one of an electron's three mutually orthogonal rings when rotating at v_m is

$$E_{ke} = \frac{1}{2}\frac{m_e}{3}v_m^2 \cong 2.7655614\text{e-}15 \text{ Joules} \tag{7}$$

where m_e is electron mass. The kinetic energy of one of a proton's three mutually orthogonal rings when rotating at v_{mp} is

$$E_{kp} = \frac{1}{2}\frac{m_p}{3}v_{mp}^2 \cong 2.7655614\text{e-}15 \text{ Joules} \tag{8}$$

where m_p is proton mass. So we see that the kinetic energy of an electron ring at its maximum difference velocity is equal to the kinetic energy of a proton ring at its maximum difference velocity. The maximum difference velocities are not equivalent, but the maximum difference *angular* velocities are equivalent. The universally applicable v_m leads to a single maximum kinetic energy per ring for both the electron and proton. We define the total 3 ring maximum kinetic energy for both electron and proton as

$$E_{km} \equiv \frac{1}{2}m_e v_m^2 \cong 8.29668418\text{e-}15 \text{ Joules} \tag{9}$$

We saw in the previous research report[2] that the magnitude of the force between two charged particles could be written as

$$F(r) = \left(\frac{\sqrt{3}b^2}{m_e c^2} + \frac{\sqrt{2}d}{c^2}\right)\frac{hc}{r^2} \tag{10}$$

where

$$b \equiv \frac{1}{v_m} \sqrt{\text{kg m}^2/\text{s}^2} \tag{11}$$

and

$$d \equiv v_m \text{ m/s} \tag{12}$$

and h is Planck's constant. Note that b and d incorporate unit transformations. We showed that the quantity in parenthesis is the fine structure constant dived by 2 π. That the electrostatic force is due to the special relativistic effect of v_m is clear, and we showed that with 11 significant digits[3] of correspondence the fine structure constant can be written[2]

$$\alpha = 2\pi\left(\frac{\sqrt{3}b^2}{m_e c^2} + \frac{\sqrt{2}d}{c^2}\right) \tag{13}$$

Among the questions that remained was why the electron mass is in the first term of the parenthetical quantity in the equation. We note now that while the demoninator of the first term is the rest energy of the electron, it is also related to the kinetic energy of both the electron and the proton at their maximum difference velocities.

It offers additional insights to write the fine structure constant in terms of the total maximum kinetic energy of a charged particle

$$\alpha = 2\pi\left(\frac{\frac{\sqrt{3}}{2}k_m}{E_{km}c^2} + \frac{\sqrt{2}d}{c^2}\right) \tag{14}$$

where k_m = kg m^4/s^4 giving a unit conversion. The most direct representation of the magnitude of the force between two charged particles in terms of their kinetic energy and angular momentum is

$$F(r) = \left(\frac{\frac{\sqrt{3}}{2}hk_m}{E_{km}c} + \frac{\sqrt{2}dh}{c}\right)\frac{1}{r^2} \tag{15}$$

Conclusion

We have expanded previous work with additional insights into the electrostatic force between charged particles. We showed that the maximum difference angular velocity of electron and proton are equivalent. We showed that the maximum kinetic energy of electron and proton are equivalent. We also showed that maximum kinetic energy is a factor in the force equation, or equivalently in the fine structure constant. We had speculated previously[2] that the √3 in the first term was related to particle total angular momentum which is √3/2 hbar, and we see in equation 15 that this has become more apparent. There are questions remaining, such as the origin of the second term in parentheses which will be addressed in future work. As an extension of our previous work, we include in Appendix A three graphs that provide further clarity into the physical structural characteristics of velocity, angular momentum, and coinciding photon emission.

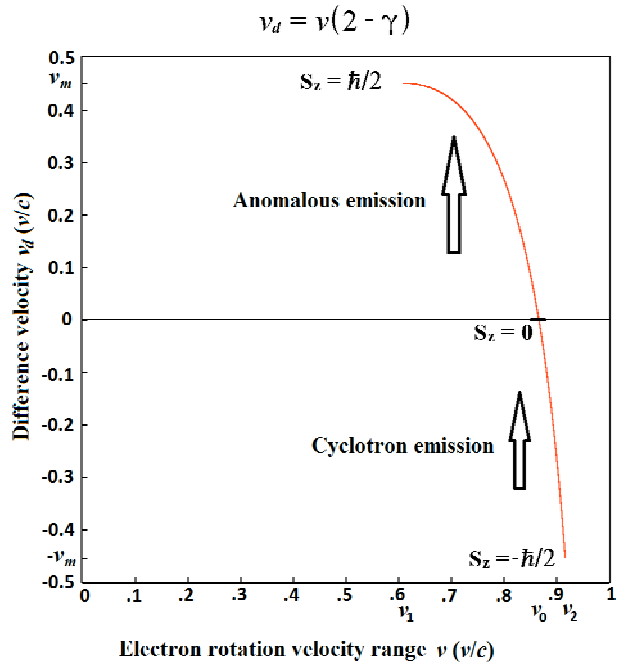
References

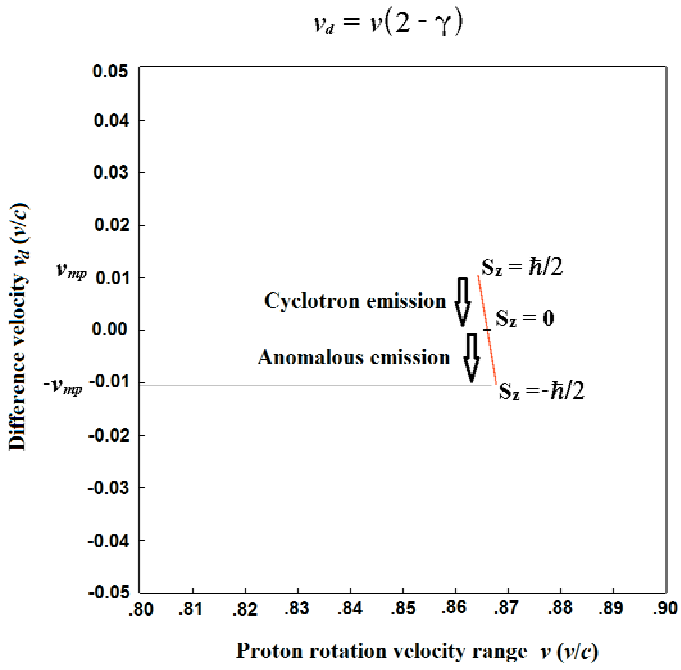
1) Smoot, G. F. (1998, February) Physics 139 Relativity Thomas Precession. Retrieved from https://jila.colorado.edu/arey/sites/default/files/files/seven(1).pdf

2) Guynn P. L., viXra [v3] 2017-06-12 15:13:52, 'Electromagnetic Effects and Structure of Particles due to Special Relativity', p.7, p.5, p.4

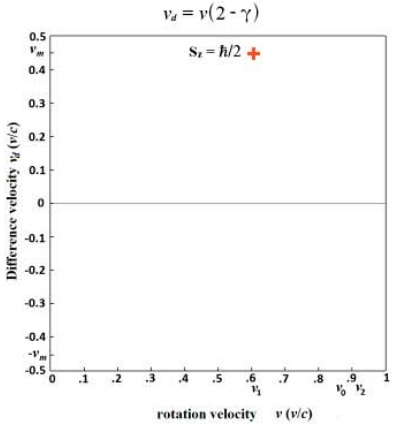
3) CODATA Recommended Values of the Fundamental Physical Constants: 2014
J. Phys. Chem. Ref. Data 45, 043102 (2016); doi 10.1063/1.4954402, 57

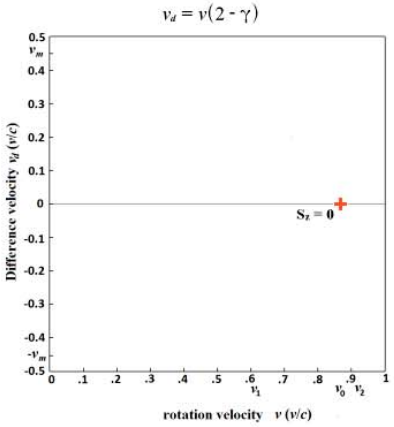
Appendix A

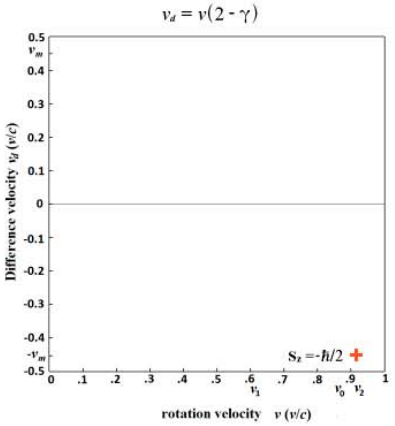

$v_d = v(2 - \gamma)$
v_m
$S_z = \hbar/2$
Anomalous emission
$S_z = 0$
Cyclotron emission
$S_z = -\hbar/2$
$-v_m$
Difference velocity v_d (v/c)
v_1
v_0 v_2
Electron rotation velocity range v (v/c)


$v_d = v(2 - \gamma)$
v_{mp}
$S_z = \hbar/2$
Cyclotron emission
$S_z = 0$
Anomalous emission
$S_z = -\hbar/2$
$-v_{mp}$
Difference velocity v_d (v/c)
Proton rotation velocity range v (v/c)

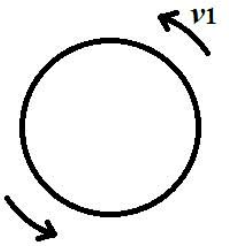
Electron rotation with difference velocity max, min, and zero

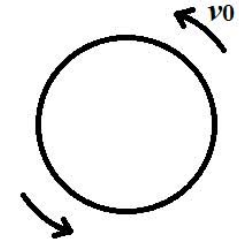


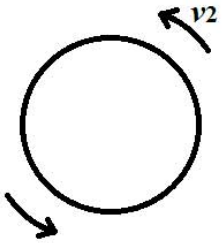




One loop top view







One loop side view, showing angular momentum