

The Physical Basis of the Fine Structure Constant in Relativistic Rotational Motion

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Abstract

The physical basis of the fine structure constant is relativistic rotational motion. Matter and its interactions consist of space time structures of rotational motion. The results of the model match experimentally determined values to within 1 part in 10^{11} .

Introduction

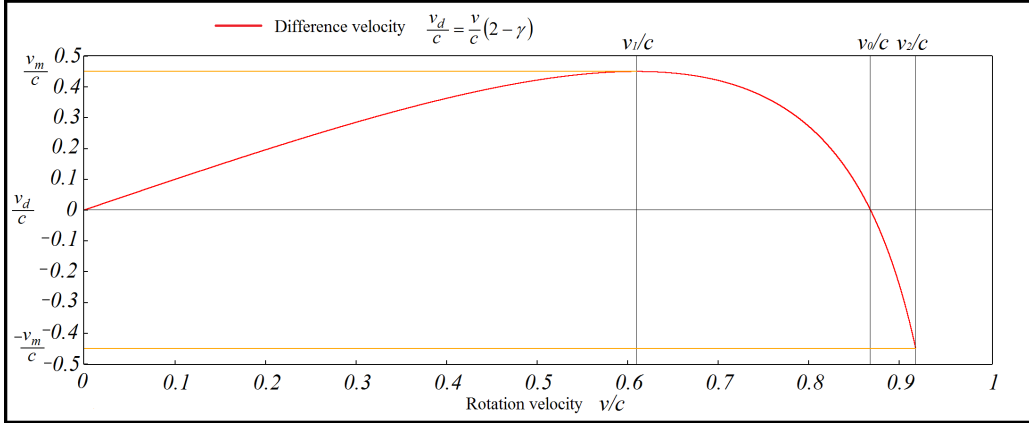


Figure 1. Difference velocity, which is rotation minus precession

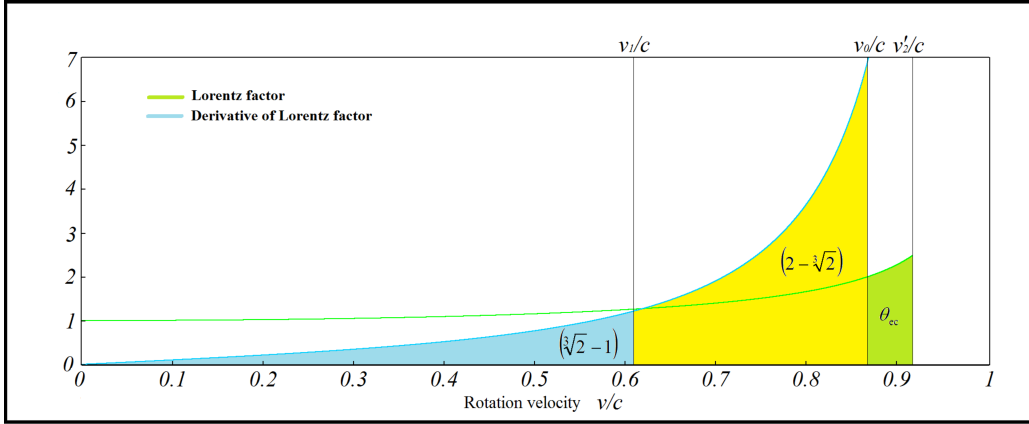


Figure 2. Areas under the curves of the Lorentz factor and its derivative

The equation for the fine structure constant α is:

$$\alpha = \int_{\theta_{ec}}^1 \frac{1}{(\theta(2 - \sqrt[3]{2}))^2} d\theta + 2\pi(2 - \sqrt[3]{2})^3 \frac{1 \text{ m/s}}{c} \approx 0.0072973525663 \quad (1)$$

where $\theta_{ec} \approx 0.11059667926806$, and c is the speed of light. The result calculated above matches the CODATA recommended value of the fine structure constant¹, $\alpha = 0.0072973525664$, to 1 part in 10^{11} , which is well within CODATA's relative standard uncertainty of 2.3×10^{-10} . The graph above has 3 vertical lines delineating characteristics of relativistic rotational motion. The first vertical line is at the rotation velocity with the maximum value of rotation minus precession, v_m/c . The second vertical line is at the rotation velocity which has rotation minus precession equal to zero. The third vertical line is at the rotational velocity which has rotation minus precession equal to $-v_m/c$. Important relationships are,

$$\frac{v_g}{c} \equiv \frac{1}{2\pi} \int_{\theta_{ec}}^1 \frac{1}{(\theta)^3} d\theta \approx 7.39437964741 \text{E} - 4 \quad \frac{v_m}{c} \equiv \frac{(2 - \sqrt[3]{2})^3}{\sqrt{2}} \approx 0.4501964643746 \quad \frac{v_2'}{c} \equiv \frac{v_2}{c} \left(1 - \frac{(\sqrt[3]{2} - 1) \text{ 1m/s}}{1 - \frac{1}{\sqrt{3}} \frac{v_g}{c}} \right) \quad (2), (3), (4)$$

The area under the curves of the Lorentz factor and the derivative of the Lorentz factor express the physical relationships leading to the fine structure constant. The constituent components not only produce the fine structure constant, but also the electron and proton mass, and they lead to the physical basis of Planck's constant. Taking the areas under the curves to the 3/2 power essentially finds the square root of the area, which is a length, and then cubes that length to get a volume. Since the Lorentz factor applies from $v = 0$ to $v < c$, including the unit of measure of velocity of 1m / s, the adjustment from v_2 to v_2' shown in Eq 4, of less than 1 part in 10^9 is required. Much of this material has been discussed in previous reports^{2,3,4,5}. The current presentation is a single page compelling proof of the relativistic space time basis of all physics.

The definitions given in equations 2 - 4 enable writing the fine structure constant as

$$\alpha = \frac{2\pi \frac{v_g}{c}}{\sqrt{2} \frac{v_m}{c}} + 2\pi\sqrt{2} \frac{v_m}{c} \frac{1 \text{ m/s}}{c} \approx 0.0072973525663 \quad (5)$$

Particle masses

The fine structure constant, based in relativistic rotational motion, describes interaction of "charged particles", actually stable rotation varying around v_0/c , with photons. Change in rotation velocity from v_2/c to v_0/c coincides with the "cyclotron" photon emission. This interaction involves recoil of the particle during photon emission, and thus particle inertial "mass" depends on rotation related to the photon emission, but not on interaction between electron and proton. The proton to electron mass ratio can be written solely in terms of the fine structure constant constituents as

$$\frac{m_p}{m_e} = \frac{\left(1 - \frac{5 v_g}{8 c}\right)^4}{2 \frac{\sqrt{2} v_g v_m}{\sqrt{3} c c}} \approx 1836.152673 \quad (6)$$

The result matches the CODATA recommended value¹ of 1836.15267389 to ten significant digits, and this is within the uncertainty of both particle masses, but is not within the uncertainty of the ratio of the two masses measured interacting with each other. The likely reason for this is that particle "energies" when interacting only with photons during cyclotron emission are different when interacting with each other directly.

$$m_p = \frac{\left(1 - \frac{5 v_g}{8 c}\right)^4}{\frac{2}{3} \left(\frac{v_g v_m}{c c}\right)^2 \left(\frac{c}{1 \text{ m/s}}\right)^4} \approx 1.6726218969 \text{E} - 27 \text{ kg} \quad (7)$$

The result matches the CODATA recommended value¹ 1.672621898E-27 kg to within experimental uncertainty. Electron "rest" energy is simply

$$E_e = m_e c^2 = \frac{\sqrt{2}\sqrt{3}}{\frac{v_g v_m}{c c}} \left(\frac{1 \text{ m/s}}{c}\right)^2 \text{ J} \approx 8.18710564965 \text{E} - 14 \text{ J} \quad (8)$$

However, "rest" energy is actually relativistic rotational space time as is the structure and interaction of all matter. The papers listed in the References section show the development leading to the current understanding that all matter and its interactions are based in relativistic rotational motion, described with units of distance, time, and their combinations and derivatives. The previous papers gave many insights for example into particle structure including proton, electron, and neutron. Since inertial "mass" is described by the constituent components of the fine structure constant, understanding of the interaction of mass gravitationally has advanced. Continuing research⁶ substantiates the finding that the "physical constants" are neither constant nor universal.

References

- 1) CODATA Recommended values of the fundamental physical constants: 2014
J. Phys. Chem. Ref. Data 45, 043102 (2016); doi 10.1063/1.4954402, 57
- 2) Guynn P. L., viXra [v1] 2018-10-27 15:02:10, 'Thomas Precession is the Basis for the Structure of Matter and Space'
- 3) Guynn P. L., viXra [v2] 2017-10-07 18:10:32, 'Electrostatic Force and Charge Structure'
- 4) Guynn P. L., viXra [v3] 2017-06-12 15:13:52, 'Electromagnetic Effects and Structure of Particles due to Special Relativity'
- 5) Guynn P. L., viXra [v1] 2017-12-05 19:25:11, 'Proton/Electron Mass Ratio and Gravitational Constant Due to Special Relativity'
- 6) Guynn P. L., viXra [v1] 2021-11-14 19:05:17, 'Jupiter's Orbit and Alignment Relative to the Galaxy is the Physical Basis of Periodic Variations of Gravitational Constant G and the Length of Day'