

The Physical Basis of Electron Mass is Relativistic Rotational Motion

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Abstract

The physical basis of electron mass is relativistic rotational motion. The result of the model matches the experimentally determined value to 9 significant digits.

Introduction

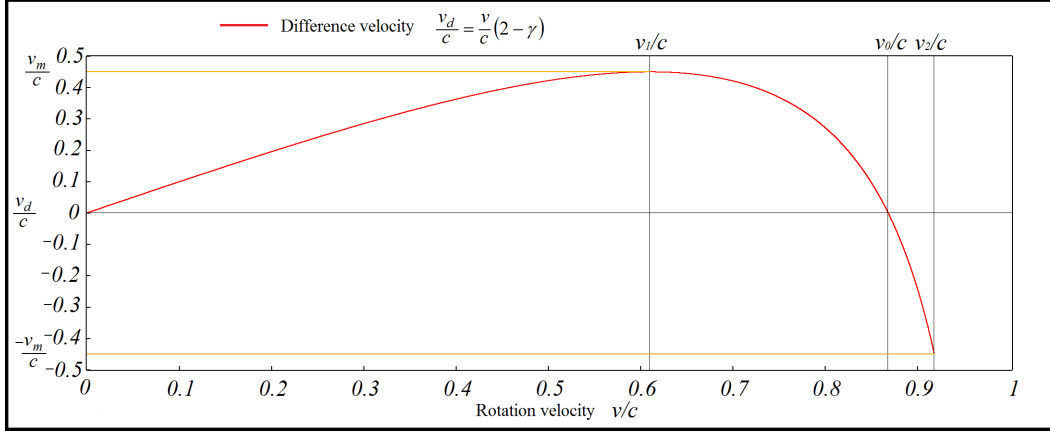


Figure 1. Difference velocity, which is rotation minus precession

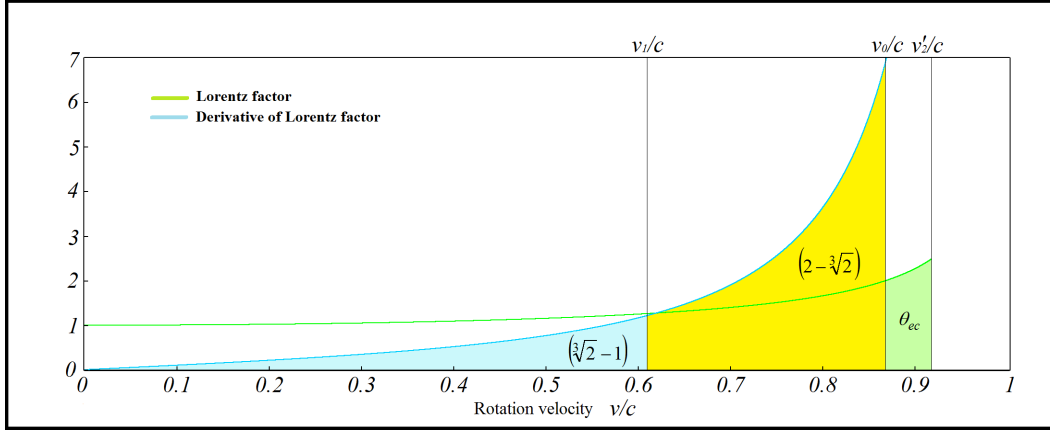


Figure 2. Areas under the curves of the Lorentz factor and its derivative

The equation for electron mass m_e is:

$$m_e = \frac{\sqrt{2}\sqrt{3}}{2\pi \int_{\theta_{ec}}^1 \frac{1}{(\theta)^{\frac{3}{2}}} d\theta} \frac{(1 \text{ m/s})^4}{(2-\sqrt[3]{2})^{\frac{3}{2}} \sqrt{2}} \text{ kg} \approx 9.10938356 \text{ E} - 31 \text{ kg} \quad (1)$$

where $\theta_{ec} \approx 0.11059667926806$, and c is the speed of light. The result calculated above matches the CODATA recommended value of the electron mass¹ $m_e = 9.10938356\text{E}-31 \text{ kg}$ exactly, which is 9 significant digits. 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 precession², 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,

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

The area under the curves of the Lorentz factor and the derivative of the Lorentz factor express the physical relationships leading to the electron mass. 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. Changes in rotational velocity correspond to changes in volume, and the ratio of the changes determine the mass m_e . 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/c to v_2'/c shown in Eq 4, of less than 1 part in 10^9 is required. Much of this material has been discussed in previous reports shown in the references^{3,4,5,6,7}. The current presentation is a single page compelling proof of the relativistic space time basis of electron mass.

References

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