

Why charge is Lorentz invariant but relativistic mass and a charge-current density is not?

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ABSTRACT

The Conclusion of

(1) Relativistic transformation of electrical current.

(2) Charge is constant from frame to frame

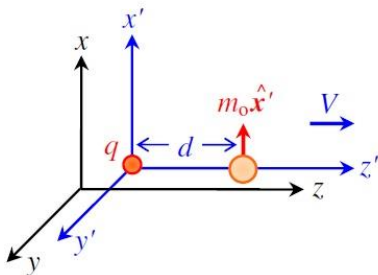
(3) Lorentz transformation of a charge-current density

Keywords

Relativistic transformation, electrical current, Lorentz transformation, a charge-current density

Introduction

Is a classical electrodynamics law incompatible with special relativity?



Contribution

Assume mass and electric current are Fifth and sixth dimensions in Special Relativity

From Equation

$$dX_1^2 - C_1^2 dT_1^2 - \frac{G_1^2}{C_{M1}^4} dM_1^2 - \frac{K_{e1} \hbar_1 G_1^2}{C_{I1}^9} dI_1^2 =$$

$$dX_2^2 - C_2^2 dT_2^2 - \frac{G_2^2}{C_{M2}^4} dM_2^2 - \frac{K_{e2} \hbar_2 G_2^2}{C_{I2}^9} dI_2^2$$

References [3]

Relativistic transformation of electrical current

$$dI_2 = \gamma dI_1$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2} \left(1 - \left(\frac{dX_{P1}}{dX_1}\right)^2\right)}}$$

$$I_2 = \frac{dQ_2}{dT_2} = \gamma I_1$$

$$\frac{dQ_2}{dT_1} \gamma = \gamma \frac{dQ_1}{dT_1}$$

$$Q_2 = Q_1$$

Charge is constant from frame to frame

Lorentz transformation of a charge-current density

$$\rho_2 = \frac{dQ_2}{dX_2} = \frac{dQ_1}{dX_2}$$

$$\rho_2 = \frac{dQ_1}{\sqrt{1 - \frac{v^2}{c^2} \left(1 - \left(\frac{dX_{P1}}{dX_1}\right)^2\right)} dX_1} = \gamma \frac{dQ_1}{dX_1} = \gamma \rho_1$$

$$\rho_2 = \gamma \rho_1$$

Conclusion

Relativistic transformation of electrical current

$$dI_2 = \gamma dI_1$$

Charge is constant from frame to frame

$$Q_2 = Q_1$$

Lorentz transformation of a charge-current density

$$\rho_2 = \gamma \rho_1$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2} \left(1 - \left(\frac{dx_{PL}}{dx_1}\right)^2\right)}}$$

References

- [1] https://www.researchgate.net/publication/315482362_Volume_Charge_Density_in_Most_General_Lorentz_Transformation/stats
- [2] https://www.researchgate.net/publication/333022391_The_sixth_Dimension
- [3] <https://phys.org/news/2012-05-classical-electrodynamics-law-incompatible-special.html>