RELATIVISTIC CLOK

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Abstract

In this paper we study once more the moving clock. In very simple calculation we show that relativistic clock slower when velocity of the reference frame (in which the clock have zero velocity) is going to c

1 Introduction

In SR formula for force(depending on energy) acting on particle with mass m, and velocity , v looks like

$$F=m\, dv/dt\left[\frac{v^2}{c^2(1-\frac{v^2}{c^2})^{3/2}}+\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right] \quad (1)$$

The relativistic part

$\left[\frac{v^2}{c^2(1-\frac{v^2}{c^2})^{3/2}}+\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right]$ ->1 , when c is going to infinity

and

F= mdv/dt

In SR-(Special relativity) total energy E is described by formula

$$E=\frac{mc^2}{\sqrt{1-\left(\frac{v}{c}\right)^2}} \quad (2)$$

And formula (1) can be written as follows

$$F = m\, dv/dt\left[\frac{v^2}{c^2}\left(\frac{E}{mc^2}\right)^3 + \frac{E}{mc^2}\right] \qquad (3)$$

And the ratio

$$\frac{F}{m\frac{dv}{dt}} = \left[\left(1 - \frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3 + \frac{E}{mc^2}\right] \qquad (4)$$

Relativistic Clock

We apply the formula (4) to the description of the relativistic oscillator

$$F = m\frac{d^2x}{dt^2}\left[\left(1 - \frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3 + \frac{E}{mc^2}\right] = fx$$

$$\frac{d^2x}{dt^2} = \frac{fx}{m\left[\left(1 - \frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3 + \frac{E}{mc^2}\right]}$$

$$\omega^2 = \frac{f}{m\left[\left(1 - \frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3 + \frac{E}{mc^2}\right]} \qquad (5)$$

In formula) m is the mass of particle and the f is elasticity factor

$$\omega^2 = \frac{f}{m\left[\left(1-\frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3+\frac{E}{mc^2}\right]}$$

(6)

$$P_{Einstein} = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{\frac{f}{m\left[\left(1-\frac{1}{(\frac{E}{mc^2})^2}\right)(\frac{E}{mc^2})^3+\frac{E}{mc^2}\right]}}}$$

Formula (6) describes the formula for the period Y of the relativistic oscillator

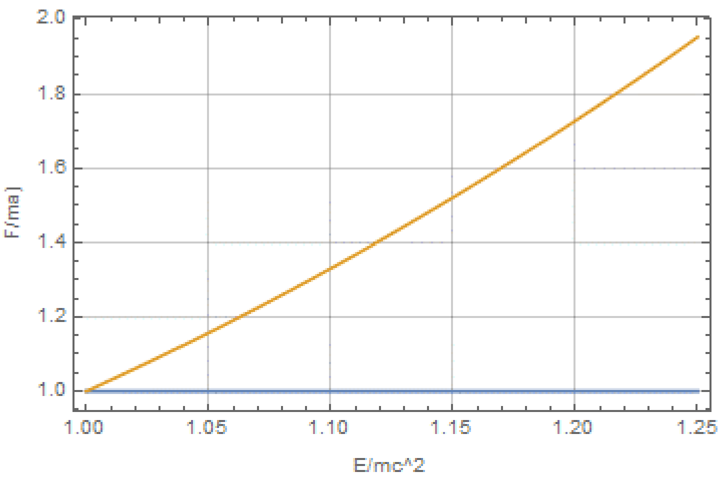
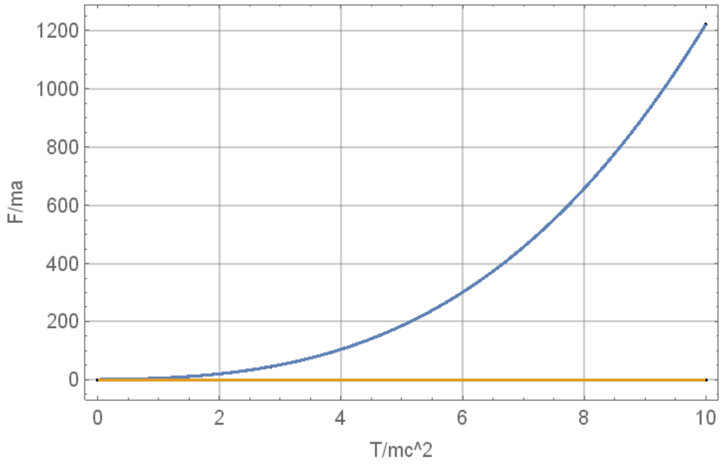


Fig.1 The Ratio $F_{Einstein}/F_{Newton}$ as the function of E/mc^2. E is the total energy $E= mc^2+T$, T is the relativistic kinetic energy of the particle

(yellow line). The blue line is the Newton formula F=ma, a is the acceleration

If in formula (2) we use the definition $E= mc^2+T$, we obtain

$F/ma=[(1- (1+T/mc^2)^2 (1+T/mc^2)^3 +1+T/mc^2]$



Fig,2 The ratio $F_{Einstein}/F_{Newton}$ as the function of T/mc^2, T is the relativistic kinetic energy (blue line). The yellow line is the Newton formula F=ma

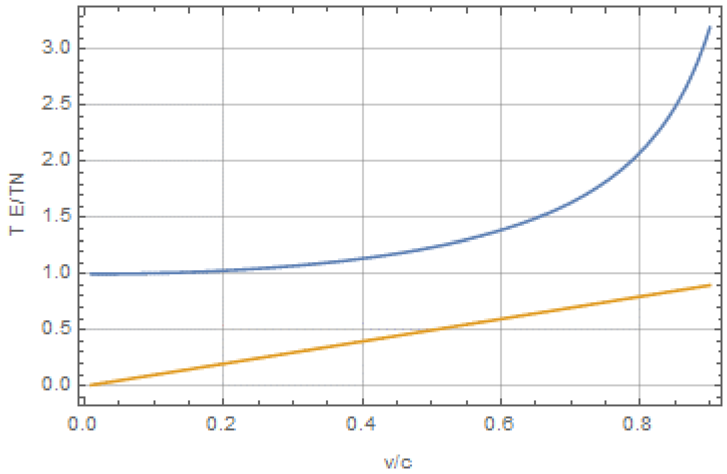


Fig.3 The ratio $T_{Einstein}/T_{Newton}$ as the function of v/c (blue line), v/c(yellow lime)

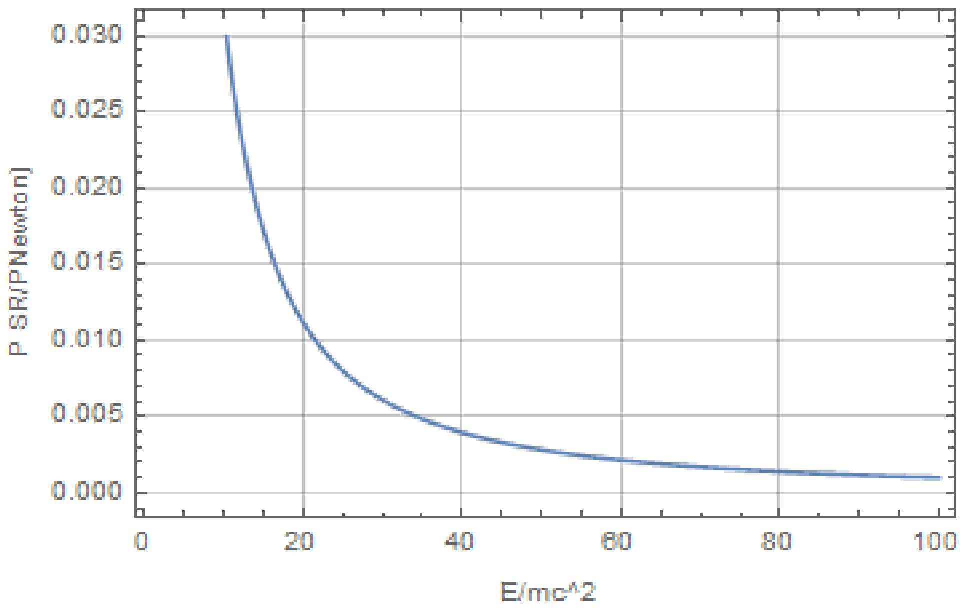


Fig.4 The ratio of the $P_{SR}/P_{Newton)}$ as the function of E/mc^2 ,P is for period

From Fig.4 we conclude that relativistic clock is going slowly when velocity of clock v-> c and stops for v=c

Conclusions

Considering the Lorentz –Poincare-Einstein transformation we calculate the timing of the relativistic clock We show,(as it must be) that relativistic clock is going slowly We calculate the slowing rate,