A NEW DYNAMICS IN SPECIAL RELATIVITY

A. Blato

(2016) Buenos Aires

Argentina

In special relativity, this article presents a new dynamics which can be applied in any inertial reference frame.

Introduction

In special relativity, the relativistic position ($\boldsymbol{\varphi}$), the relativistic velocity ($\dot{\boldsymbol{\varphi}}$) and the relativistic acceleration ($\ddot{\boldsymbol{\varphi}}$) of a particle are given by:

$$\boldsymbol{\varphi} \doteq \mathbf{r}$$

$$\dot{\boldsymbol{\varphi}} \doteq \frac{d\boldsymbol{\varphi}}{d\tau} = \frac{\mathbf{v}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\ddot{\boldsymbol{\varphi}} \doteq \frac{d\dot{\boldsymbol{\varphi}}}{d\tau} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \left[\frac{\mathbf{a}}{\sqrt{1 - \frac{v^2}{c^2}}} + \frac{(\mathbf{a} \cdot \mathbf{v})\,\mathbf{v}}{c^2 \left(1 - \frac{v^2}{c^2}\right)^{3/2}} \right]$$

where ($\mathbf{r}$, $\mathbf{v}$, $\mathbf{a}$) are the position, the velocity and the acceleration of the particle. (τ) is the proper time of the particle. $d\tau = \sqrt{1 - v^2/c^2}\; dt$

The Poincarian Dynamics

In special relativity, if we consider a particle with rest mass m_o then the linear momentum $\mathbf{P}$ of the particle, the net Poincarian force $\widehat{\mathbf{F}}$ acting on the particle, the work W done by the net Poincarian force acting on the particle, and the kinetic energy K of the particle, for an inertial reference frame, are given by:

$$\mathbf{P} \doteq m_o \, \dot{\boldsymbol{\varphi}}$$

$$\widehat{\mathbf{F}} = \frac{d\mathbf{P}}{d\tau} = m_o \, \ddot{\boldsymbol{\varphi}}$$

$$\mathrm{W} \doteq \int_1^2 \widehat{\mathbf{F}} \cdot d\boldsymbol{\varphi} = \Delta\, \mathrm{K}$$

$$\mathrm{K} \doteq {}^1\!/_2 \; m_o \, (\dot{\boldsymbol{\varphi}} \cdot \dot{\boldsymbol{\varphi}})$$

where ($\boldsymbol{\varphi}$, $\dot{\boldsymbol{\varphi}}$, $\ddot{\boldsymbol{\varphi}}$) are the relativistic position, the relativistic velocity and the relativistic acceleration of the particle relative to the inertial reference frame.

$\widehat{\mathbf{F}} = \gamma \, \mathbf{F}$ (where γ is the Lorentz factor and $\mathbf{F}$ is the net Einsteinian force acting on the particle)

The relativistic acceleration $\ddot{\boldsymbol{\varphi}}$ of a particle is always in the direction of the net Poincarian force $\widehat{\mathbf{F}}$ acting on the particle.