AN ALTERNATIVE FORMULATION OF SPECIAL RELATIVITY

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(2016) Buenos Aires
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This article presents an alternative formulation of special relativity which can be applied in any inertial reference frame. In addition, a new universal force is proposed.

Introduction

The invariant mass \( m \) and the frequency factor \( f \) of a massive particle are given by:

\[
m \doteq m_0
\]
\[
f \doteq \left(1 - \frac{v \cdot v}{c^2}\right)^{-1/2}
\]

where \( m_0 \) is the rest mass of the massive particle, \( v \) is the velocity of the massive particle and \( c \) is the speed of light in vacuum.

The invariant mass \( m \) and the frequency factor \( f \) of a non-massive particle are given by:

\[
m \doteq \frac{h \kappa}{c^2}
\]
\[
f \doteq \frac{\nu}{\kappa}
\]

where \( h \) is the Planck constant, \( \nu \) is the frequency of the non-massive particle, \( \kappa \) is a positive universal constant with dimension of frequency and \( c \) is the speed of light in vacuum.

In this article, a massive particle is a particle with non-zero rest mass and a non-massive particle is a particle with zero rest mass.
The Alternative Kinematics

The special position \( \bar{r} \), the special velocity \( \bar{v} \) and the special acceleration \( \bar{a} \) of a (massive or non-massive) particle are given by:

\[
\bar{r} \doteq \int f \, v \, dt \\
\bar{v} \doteq \frac{d\bar{r}}{dt} = f \, v \\
\bar{a} \doteq \frac{d\bar{v}}{dt} = f \, \frac{dv}{dt} + \frac{df}{dt} \, v
\]

where \( f \) and \( v \) are the frequency factor and the velocity of the particle.

The Alternative Dynamics

If we consider a (massive or non-massive) particle with invariant mass \( m \) then the linear momentum \( P \) of the particle, the angular momentum \( L \) of the particle, the net force \( F \) acting on the particle, the work \( W \) done by the net force acting on the particle, and the kinetic energy \( K \) of the particle, for an inertial reference frame, are given by:

\[
P \doteq m \, \bar{v} = m \, f \, v \\
L \doteq P \times r = m \, \bar{v} \times r = m \, f \, v \times r \\
F = \frac{dP}{dt} = m \, \bar{a} = m \left[ f \, \frac{dv}{dt} + \frac{df}{dt} \, v \right] \\
W \doteq \int_1^2 F \cdot dr = \int_1^2 \frac{dP}{dt} \cdot dr = \Delta K \\
K \doteq m \, f \, c^2
\]

where \( f, r, v, \bar{v}, \bar{a} \) are the frequency factor, the position, the velocity, the special velocity and the special acceleration of the particle relative to the inertial reference frame and \( c \) is the speed of light in vacuum. The kinetic energy \( (K_o) \) of a massive particle at rest is \( (m_o \, c^2) \)
The Kinetic Force

In an isolated system of (massive or non-massive) particles, the kinetic force $K_{ij}$ exerted on a particle $i$ with invariant mass $m_i$ by another particle $j$ with invariant mass $m_j$ is given by:

$$K_{ij} = -\left[ \frac{m_i m_j}{M} (\bar{a}_i - \bar{a}_j) \right]$$

where $\bar{a}_i$ is the special acceleration of the particle $i$, $\bar{a}_j$ is the special acceleration of the particle $j$ and $M (= \sum_z m_z)$ is the invariant mass of the isolated system of particles.

From the above equation it follows that the net kinetic force $K_i (= \sum_z K_{iz})$ acting on the particle $i$ is given by:

$$K_i = -m_i \bar{a}_i$$

where $m_i$ is the invariant mass of the particle $i$ and $\bar{a}_i$ is the special acceleration of the particle $i$.

Now, substituting ($F_i = m_i \bar{a}_i$) and rearranging, we obtain:

$$T_i = K_i + F_i = 0$$

Therefore, in an isolated system of (massive or non-massive) particles, the total force $T_i$ acting on a particle $i$ is always zero.

In this article, the linear momentum of an isolated system of (massive or non-massive) particles is conserved ($\sum_z m_z \bar{v}_z = constant$)

Bibliography

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Appendix I

System of Equations I

\[ \begin{align*}
[1] & \quad \frac{1}{\mu} \left[ \int P \, dt - \int \int F \, dt \, dt \right] = 0 \\
[2] & \quad \frac{1}{\mu} \left[ P - \int F \, dt \right] = 0 \\
[3] & \quad \frac{1}{\mu} \left[ \frac{dP}{dt} - F \right] = 0 \\
[4] & \quad \frac{1}{\mu} \left[ P - \int F \, dt \right] \times r = 0 \\
[5] & \quad \frac{1}{\mu} \left[ \frac{dP}{dt} - F \right] \times r = 0 \\
[6] & \quad \frac{1}{\mu} \left[ \int \frac{dP}{dt} \cdot dr - \int F \cdot dr \right] = 0
\end{align*} \]

[\mu] is an arbitrary constant with dimension of mass (M)
Appendix II

System of Equations II

\[ 1 \] \[ \frac{1}{\mu} \left( m \ddot{r} - \int \int F \, dt \, dt \right) = 0 \]

\[ 2 \] \[ \frac{1}{\mu} \left( m \ddot{v} - \int F \, dt \right) = 0 \]

\[ 3 \] \[ \frac{1}{\mu} \left( m \dddot{a} - F \right) = 0 \]

\[ 4 \] \[ \frac{1}{\mu} \left( m \ddot{v} - \int F \, dt \right) \times r = 0 \]

\[ 5 \] \[ \frac{1}{\mu} \left( m \dddot{a} - F \right) \times r = 0 \]

\[ 6 \] \[ \frac{1}{\mu} \left[ m f c^2 - \int F \cdot dr \right] = 0 \]

\( [\mu] \) is an arbitrary constant with dimension of mass \((M)\)