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Energy in Vectorial Relativity: E ≈ m.c^2

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ABSTRACT: In previous work it was shown that assumptions, $y' = y$ and $z' = z$, within Lorentz Transformations were needless, and therefore groundless. Because of such assumptions, Lorentz Transformations (LT) depend on the body's spatial orientation, i.e. the well-known transverse and longitudinal transformations of magnitudes, characterized by different scaling factors. On the contrary, the development of LT without assumptions, brought about new transformations that do not depend on spatial orientation, and a unique mass definition was devised, $m = \frac{M_0}{\left(1-\frac{v^2}{c^2}\right)^{\frac{3}{2}}}$. As it is known, Einstein arrived at two definitions: transverse mass $m_T = \frac{M_0}{\left(1-\frac{v^2}{c^2}\right)^{\frac{1}{2}}}$ and longitudinal mass $m_L = \frac{M_0}{\left(1-\frac{v^2}{c^2}\right)^{\frac{3}{2}}}$. This latter coincides with our obtained definition. In the current work, based on the unique definition of mass, new expressions of Energy and Momentum were derived. As an interesting result, it was encountered that Einstein's equation $E = m.c^2$ is only valid for particles with null mass at rest (i.e. photons). In contrast, it was noticed that $E = m.c^2$ works as a very good approximation in energy calculations for bodies with non-null mass at rest, at speeds less than two thirds that of light. By applying the new expression of Energy, a modified Schrödinger Equation was obtained.

KEYWORDS: Special Relativity, Relativistic Mass, Relativistic Energy and Relativistic Momentum, Schrödinger Equation (Modified).

I. INTRODUCTION

The concept of variation of a mass m with its velocity v, through its rest mass M_0 and the universal constant speed of light c, in rectilinear motion, given by $m = \frac{M_0}{\sqrt{1-\frac{v^2}{c^2}}}$, was originally established by Einstein in the section §10, of his seminal paper about relativity on June 30th, 1905 [1]. Doubtlessly, the mass dependence of a body on its velocity was one of the major outcomes of the Special Theory of Relativity. Additionally, in the same section §10, Einstein *indirectly* sets up (with another notation)

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his referred famous equation, through the derivation of the kinetic energy of the electron, $K = m.c^2 - M_0.c^2$.

V. CONCLUSION

Although the quantitative gain in precise measurements of the energy are not so significant, because Einstein's energy expressions are a good approach in the most of practical cases to experimental values, in our opinion the theoretical corrections informed in this work for the definitions of mass and Energy given by Einstein are very relevant, from a conceptual point of view in theoretical physics. May be, further measurements of matter characteristics, others than Energy, could lead to find relevant differences favoring the new dynamical definitions reliant on new mass and energy definitions given in this and in the previous work. On the other hand, in this work we could introduce the relativistic concepts into the Schrödinger Equation in a simple way, thanks the direct dependence on velocity of our energy expressions. We believe that this work has set a simple and direct bridge between Relativistic Theory and Quantum Mechanics, signifying a contribution to the unification of physics, conceptually speaking.

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