

Review of: "Distinguishing Absolute True Time from Relative Time: Consistency of Quantum Mechanics and Relativity"

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The paper presents an important contribution to revise our familiar notions of mass and energy according to the special theory of relativity and quantum mechanics. I agree with the author that by simply increasing the velocity of a particle, its mass cannot increase, although its energy will increase. However, I feel very strongly that the increase in the internal energy of the particle can instead be explained by resorting to string theory, wherein the particle is composed of several vibrating strings which, when the particle's velocity increases, will start vibrating at higher frequencies, thereby causing other elementary particles to show up within the string spectrum. The increase in the particle's energy must therefore not be attributed to an increase in its mass, but rather to the appearance of extra modes of the strings within it. Using second quantized Bosonic string theory, we know that the string energy/Hamiltonian can be expressed as a sum of Hamiltonians of 26 dimensional quantum Harmonic oscillators, or if we adopt the light cone gauge, the sum of 24 dimensional transverse Harmonic oscillators. The internal state of the particle will therefore change to a state describable as a superposition of the corresponding number states, and we will then no longer have any contradiction. After all, in string theory, the basic constituents of matter are strings, or more precisely superstrings, comprising Bosonic and Fermionic strings whose states can be interpreted in terms of elementary particles that we understand from conventional quantum field theory, like super-Yang-Mills matter and gauge particles, gravitons, and gravitinos, etc. I also agree with the author that we do not require to change the special relativistic theory of time dilation. What we just require to do is to explain the increase in the particle's mass when its velocity increases in terms of the change in the state of quarks, Leptons, and gauge particles that the particle is composed of. I recommend publication after the author suggests some concrete quantum mechanical methods of reinterpreting the increase in mass. The paper is well-written and gives a significant revision to the special theory of relativity.

One way that I suggest is to assume that the particle is composed of more elementary particles (in the language of Feynman, partons) and write down the total quantum mechanical Hamiltonian of this system of particles in terms of their kinetic energy operators and their binding potential energy that causes the particle to appear as a cohesive unit, and then change the coordinate system according to Newtonian mechanics so that the Hamiltonian of this system gets altered. Then solve the Schrödinger equation for the eigenstates of this collection of particles and interpret the change in the resulting energy eigenvalues of this system of elementary particles in terms of the other forms of energy mentioned by the author in the paper.

In string theory, there is an algorithm called compactification. If we take a ten-dimensional superstring and compactify six

of its space-time dimensions so that the uncompactified dimensions represent our conventional space-time, then the six-dimensional part of the Dirac operator, when operating on the six-dimensional component of the wave function, will have eigenvalues that contribute to the energy of the particle moving in the four-dimensional space-time.

String theory can be applied to the author's work by reinterpreting the mass of the particle in terms of an increase in the energy of the compactified component that is invisible in the four-dimensional world.