<u>Superluminal velocities and exotic matter,with quantum entanglement equivalence.</u>

Suresh Kumar S

ABSTRACT.
It is possible that relativistic particles experiencing time dilation and space contraction Lorentz transformation effects are measured to have velocities less than what they actually possess,based on relationality principle and interrelatedness of masses,which evidence as inertia. Hence possibilities for superluminal velocities to be measured as relativistic speeds tending to absolute velocity or conforming to the speed of light exists.
This can have implications for exotic matter and exotic geometries with quantum entanglement equivalence.

Background.

The relative mass must increase with speed in such a way as to cancel out the smaller y -direction velocity resulting from time dilation. That is to say, if an object at rest has a mass m0, moving at a speed v it must have mass

$$m=m0/(1-(v^2/c^2))^{1/2}$$

to conserve y -direction momentum.

We know that this is an exceedingly small effect at ordinary speeds, but as an object approaches the speed of light, the mass increases almost exponentially,and it is found that this mass correction factor does indeed ensure momentum conservation for any collision in all inertial frames.

We observe that in particle accelerators very powerful electric fields are used to accelerate electrons, protons and other particles. It is found that these particles become heavier and heavier as the velocities approach the speed of light , and would eventually need greater and greater forces for accelerating further . We have the speed of light as a natural absolute speed limit. Particles are accelerated to speeds where their relative masses are thousands of times greater than their rest masses or invariant masses measured at rest.

Details.

We know the correct expression for the momentum of a particle having a rest mass m moving with velocity v is
$p= m.v/(1-(v^2/c^2))^{½}$ or
$p =m(rel).v$,where m(rel) represents relative mass.

In fact, a relativistic particle ,as we understand, undergoes Lorentz contraction along the direction of motion,in addition to time dilation.

The m(rel) is considerably larger than m,the invariant mass,for a particle at relativistic velocities. Naturally the kinetic energy also increases.
The kinetic energy itself has inertia. Now as a defining property of mass, inertia means it's harder to accelerate, and more inertia means,a given force accelerates it less. The other fundamental property of mass is that it attracts gravitationally. The particles will have increased (relativistic) mass, corresponding to the increased kinetic energy, and the external gravitational field will have increased proportionally.

The relativistic mass is the total energy, with the rest mass itself now seen as rest energy,given the equivalence of inertial and gravitational mass,and energy mass equivalence. It should be added that the rest mass plays an important role as an invariant pne,on going from one frame of reference to another, but the "relativistic mass" is really the first component (the energy) of the four dimensional energy-momentum vector of a particle, and so is not a Lorentz invariant.

In special relativity mass and energy are not separately conserved,given the mass energy equivalence such that in certain situations mass m can be converted to energy $E=mc^2$. This equivalence is closely related to the mass increase with speed. Hence if a constant force F accelerates a particle of rest mass m_0 in a straight line, work done by the force as it travels a distance d is Fd, and which is same as the particle kinetic energy.

Consider the case of a relativistically accelerated particle,and the kinetic energy of a particle in accelerators where the change of speed with increasing momentum is negligible! Instead,

$F=dp/dt=d(mv)/dt \cong d(m).c/dt$, force F, can be equated with the rate of change of momentum,p with time,as represented by dp/dt.

Here,as usual c is the speed of light. This is what happens in a particle accelerator for a charged particle in a constant electric field, with $F=qE$.

Since the particle is moving at a speed very close to c, in time dt it will move cdt and the force will do work Fcdt. The equation above can be rewritten

Fcdt=(dm)c2.
So the energy dE expended by the accelerating force in the time dt yields an increase in mass, and dE=(dm)c2. Provided the speed is close to c, this can of course be integrated to an excellent approximation, to relate a finite particle mass change to the energy expended in accelerating it.

Conclusion.

Now consider that interelatedness of particle masses and energies,based on a relationality principle,that equates inertial mass with gravitational mass and energy with mass.
It is possible for an observer to be influenced by the time dilation and space contraction effect on the particle being observed. It could be such that the measured velocity of the observed particle,in the relativistic limit,is less than the actual velocity of the particle. Hence superluminal particle velocities could be measured by observers as not exceeding the absolute velocity,or conforming to the speed of light.

However,such superluminal photons in the real should be measured or observed as dark energy photons with repulsive gravity than attractive one and having negative curvature space time effects than positive curvature.
It is also possible to associate them with exotic matter and worthy geometries such that quantum like tunneling effects could ensue,and have equivalence with quantum entanglement.