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Gauge Transformation for Relativity (GTR)

Abstract
This article describes special relativity as an effect in the phase of wave functions. It is demonstrated that general relativity may be seen as a pure quantum effect. Via the link between potentials and the phase of wave functions a path is presented to translate relativity into a gauge transformation of quantum theory.

In the quantum theory the wave function is the most complete description that can be given to a physical system. Solutions to Schroedinger's equation describe atomic and subatomic particles, electrons and atoms. For a general quantum system the well known Schroedinger equation with the Hamilton Operator H can be written as

$$\mathrm{i}\hbar\frac{\partial}{\partial t}\,\psi\,(\mathrm{x},\mathrm{t}) = \mathrm{H}\;\psi\,(\mathrm{x},\mathrm{t}) \tag{1}$$

This can be formulated for one particle

$$\mathrm{i}\hbar\frac{\partial}{\partial t}\,\psi\,(\mathrm{x},\mathrm{t}) = \left(-\frac{\hbar^2}{2\mathrm{m}}\,\Delta\;+\mathrm{V}(\mathrm{x},\mathrm{t})\right)\;\psi\,(\mathrm{x},\mathrm{t}) \tag{2}$$

With the classical separation of variables and $V(x,t) = V(x) \sim kx^2$ we get the quantum harmonic oscillator.

$$\psi\,(\mathrm{x},\mathrm{t}) = \varphi(\mathrm{x})\;\mathrm{e}^{\frac{-\mathrm{i}}{\hbar}\mathrm{E}\,\mathrm{t}} \quad \text{and} \quad E\;\psi\,(\mathrm{x},\mathrm{t}) = \left(-\frac{\hbar^2}{2\mathrm{m}}\,\Delta\;+\mathrm{V}(\mathrm{x})\right)\;\psi\,(\mathrm{x},\mathrm{t}) \tag{3}$$

This is one of the most important models in quantum theory because an arbitrary potential can be approximated as a harmonic potential near the stable equilibrium point and so it is one of the best generic models for describing quantum effects and one of the rare equations that can be solved analytically by the Hermite Polynomials.

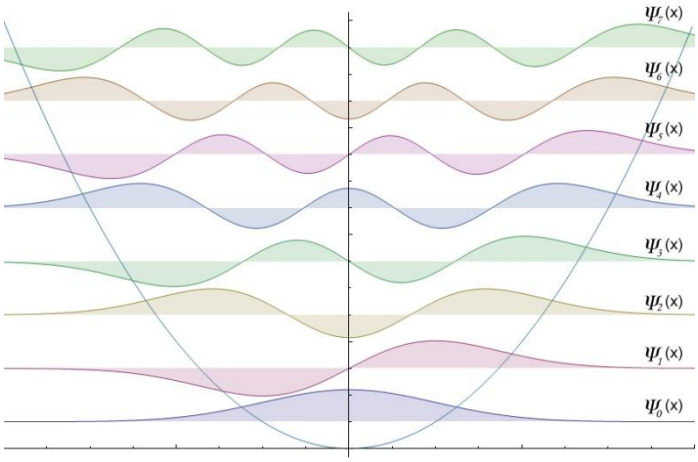

Figure 1 , Wave functions of the harmonic quantum oscillator, © by Allen McCloud

Many theoretical physicists take the resulting wave functions as a pure mathematical tool, but the Aharonov-Bohm effect shows clearly, that the phase of a wave function is a physical quantity that must be respected [1]. In this way the relativistic equations can be derived.

Fig. 1: Wave with quantum walls at rest

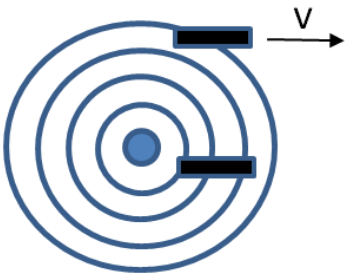

Fig. 2: Wave with moving quantum walls

If we look at figure 1 we see a wave between two quantum walls at rest. This may represent for example a muon or the resonator cavity of an atomic clock. One standing wave is equivalent to two waves running contrarily. Each time the wave hits the wall there is a definite probability for tunneling and decay. Let's call this wall hit one 'tick'.

When the walls are moving , see figure 2, the wave hits the upper wall after a longer distance and longer time. We can describe this quantitatively according to figure 3. with the following definitions.

t_r := Travelling wave time with walls at rest := tick time of resting clock

t_m := Travelling wave time with walls moving := tick time of moving clock

ct_r := S_r := Travelling wave distance between the walls at rest

ct_m := S_m :=Travelling wave distance between the walls moving

vt_m := Travelling distance of the walls

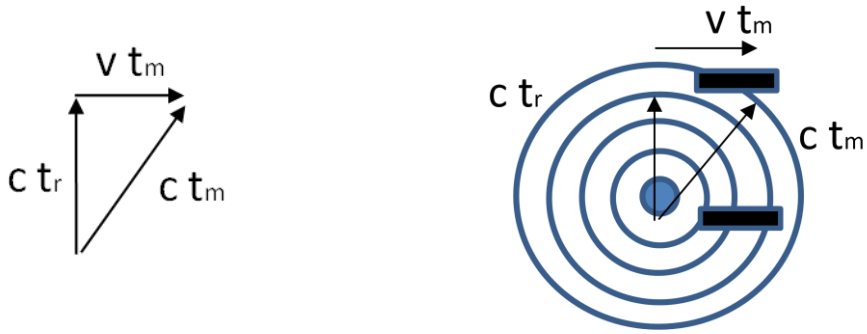

Fig. 3: Travelling distances

We can formulate this mathematically

$$(ct_m)^2 = (ct_r)^2 + (vt_m)^2$$

This is equivalent to

$$t_m = \frac{t_r}{\sqrt{1-\frac{v^2}{c^2}}}$$ what is the same as the relativistic formula for time dilation.

Now one tick takes longer and the life time of the muon is extended accordingly.

If we analyze the travelling distances we get

$$\frac{S_m}{S_r} = \frac{c\,t_m}{c\,t_r} = \frac{t_m}{t_r} = \frac{t_r}{t_r\sqrt{1-\frac{v^2}{c^2}}} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

It's obvious that in this model the velocity, resp. the speed of light, is the same in any inertial system without the need of any postulate:

$$\frac{S_r}{t_r} = \frac{S_m\sqrt{1-\frac{v^2}{c^2}}}{t_m\sqrt{1-\frac{v^2}{c^2}}} = \frac{S_m}{t_m}$$

One may argue that the Michelson-Morley experiment disproved such a model, but the basic assumptions of this experiment are already wrong. Such kind of experiment just compares the relativistic effects on light waves with the relativistic effects of the housing, i.e. electron waves. The absence of effects does not show that photons are not effected, but it shows, that photons and electrons are effected in the same way. With todays knowledge about the wave characteristic of electrons nobody should cite such an experiment with totally wrong assumptions. The designers of gravitational wave detectors should think about this, too.

The mass increase is solely caused by an increase of velocity. This energy is classically defined as

$$E_{kin} = \frac{1}{2}mv^2 = mc^2\frac{v^2}{2c^2}$$

with x= $-\frac{v^2}{c^2}$ and $\sqrt{1+x} = 1+\frac{1}{2}x-\frac{1}{8}x^2+\frac{1}{16}x^3-\frac{5}{128}x^4$ ...

neglecting the terms that are divided by powers of c we get

$$E_{kin} = mc^2\left(1-\left(1-\frac{v^2}{2c^2}-\frac{v^4}{8c^4}-\frac{v^6}{16c^6}\ldots\right)\right) = mc^2\left(1-\sqrt{1-\frac{v^2}{c^2}}\right)$$

$$E_{kin} = mc^2 - mc^2\sqrt{1-\frac{v^2}{c^2}} = mc^2 - m_0c^2 = E_{relativistic}$$

$$E_{kin} = E_{relativistic}$$

Mass is not a kind of energy, but it is identical with kinetic energy, in some way like temperature is the average movement of subparticles.

The rest mass m_0 may be generated in the same way by oscillations of subparticles. A complicated construction like the Higgs particle is not necessary in this model. See fig 4.

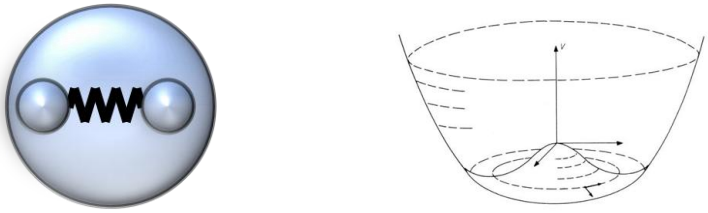

Fig 4 : Rest mass model

In this model mass exists hierarchically as kinetic energy. Rest mass is identical to inertial mass with a body that has a non moving mass center. Any mexican hat potential can generate rest mass, not only the higgs mechanism.

Different particles with similar behaviour like taus, muons and electrons may be interpreted as higher oscillation modes of the same generic particle.

Back to fig 2, we have the same questions as in special relativity. Is the wall moving or the surroundings, but we can solve this like in general relativity. Only acceleration can generate the movement, so we can decide whether the quantum walls were accelerated and have time dilation. Nevertheless for the inertial system with the quantum walls physical processes may seem to be the same because they are influenced by the number of ticks. As a result we can give a reason for time dilation without attaching physical properties at time itself. It's quantum wave mechanics. In this model there is no curvature of space and time. If you change a local reference system nothing happens in the universe. It is flat and time is global. You can use the frequency of a pulsar or even better the mean frequency of several pulsars to generate a global time standard, but atomic clocks need a readjustment each time after acceleration, like any other clock, too. The idealistic behaviour of small circles with pointers inside, that are called clocks in the theory of relativity, is unrealistic. No reputable physicist would accept a definition like 'velocity is what the speedometer shows'. But in the theory of relativity the definition 'time is what the clock shows' is used permanently, even without specifying a clock. A better definition for time measuring would be 'measuring the phase of a standing wave in an inertial reference system'. With this definition it is clear that atomic clocks have shifts when they change the reference system. The equivalence principle is invalid. It's a wrong philosophical point of view that prevents the detection of new physics. The scientists look for more and more correction factors to save the equivalence principle like astronomers in the middle ages who wanted to describe the movement of planets

with the earth in the center of the universe. The theory of relativity is the same mistake on a higher level. Again we make our own system unchangable, even under acceleration, and insist that the universe itself changes. Under this assumption you cannot find easy solutions. If we look at current cosmological publications the postulate of the speed of light as the maximum velocity is already disproved for galaxies [2]. Even the basic equivalence principle is disproved by finestructure constant measurements in quasars. Furthermore the concept of time lapse in the whole universe by changing a local reference system is very unlogical and unphysical.

In this way relativity is a shortcut to calculate in the macroscopic world where it seems adequate, but the Schroedinger equation is the fundamental equation to describe the effects and the theory of special relativity can be derived from quantum theory. Furthermore there may be solutions with mass at a distance of particles, because the energy, i.e. mass, is in the system of wave functions, what may lead to an explanation of dark matter. Todays physicists try to explain nature by particles, but quantum waves exist, interfere and diffract independent from particles. This can be proven by a double slit experiment with an intensity, where only a single particle can exist during interference. So the quantum waves with low intensities in the halo of a galaxy may be the reason for dark matter without any particles.

We can see that special relativity can be interpreted as a quantum effect caused by the phase of wave functions. It is well known that there is a direct link between the phase of a wave function and gauge transformations.

$A(x,t) = A'(x,t) + \nabla\chi(x,t)$ and $\phi(x,t) = \phi'(x,t) + \frac{1}{c}\frac{d\chi(x,t)}{dx}$ result in a phase shift for the wave function $\psi(x,t) = e^{\frac{iq\chi(x,t)}{\hbar c}}\psi'(x,t)$.

If we take now the wave function we see how relativity can be formulated as fields.

General Relativity as a gauge transformation of special relativity can now be formulated as a gauge transformation of quantum theory and can be merged with the standard model of elementary particles [3]. In this model gravity means diffraction of wave functions by other wave functions and it is a result of the quantum mechanical superposition principle $|\varphi> = \sum_i |\varphi_i>$ having deviations 40 digits after the point.

These equations also have a deep philosophical meaning. Since the detection of relativity by Einstein every physicist looking at the equations wondered what curvature of space

and time really means. It was assumed that it is a basic property of space and time, because no reason for it was in sight. In this model it is a pure quantum effect. Furthermore the barrier of the speed of light is a barrier in the local group velocity of wave functions. In this model the superluminal signal transmission waves, measured by Nimtz are easily understood [4]. In the relativistic standard model this is a contradiction.

In total ignorance of any physical experiment leading physical theoretical physicists even expect the possibility of time travelling and mix physics with science fiction by the misinterpretation of a mathematical orthogonal time parameter with a physical dimension.
The definition 'measuring the phase of a standing wave in an inertial reference system' gives a first physical reason why time cannot run backwards. If you look at an animation of a standing wave, e.g. in wikipedia, you can see that a standing wave has no forwards or backwards. Forwards and backwards are identical, that means the basic physical time element can explain here the characteristic of time that there is change, but time does not run forwards or backwards.

Up to now the wave function is the most basic physical property but there is no general barrier as a property of space and time. It is wrong to attach physical properties directly to time. That is a dead end. Of course Lorentz' and Poincare's equations are right, but Einstein's explanations based on a causeless hidden connection between space and time is unnecessary. This is not science, but the attraction of mystic explanations, seeming irresistible to many people. Einstein's postulate is a bare capitulation to understand nature. Advanced technical measurements base on electromagnetic waves in our civilization. Assume a civilization which uses sonic waves and builds clocks according to Fig.3 . They will get the same equations with c as the speed of sound. They may now assume that the speed of sound is a fundamental constant in nature that is the same in any inertial system and that connects the spatial dimensions with the time dimension. Of course this is also wrong and only a result of the way time is measured. They may be stupid enough to define the event of happening by the event of listening to something and if they get more and more experimental data that does not fit anymore they invent the peculiar velocity. The effects are analog but depend on the used wave velocity in the clock.

What about the energy that looks like rising to infinite quantities, although complete galaxies move faster than light. I guess that we should look back in history. The energy density for sonic waves is proportional to ω^2. We may argue now that it is not possible to fly faster than the speed of sound, because of the Doppler effect what is of course absurd, because airplanes do this every day. We should learn, that singularities are not real, but phase transitions to new physics. With an equivalence principle at this point we could never ever make this transition. The problem can be solved here, if we assume that the Planck constant may decrease at extremely high energy levels. Effects like a shift of the frequency distance of emission lines in the spectrum of the most distant astronomical objects or other disturbances can be an indicator and gamma ray bursts may be interpreted as Cherenkov radiation. It may be interesting to analyze the measured red shifts and recession velocities of quasars potentially higher than the speed of light under this aspect. It can be measured for example by different z values in the spectrum of one object. Another possibility is the measurement of an increased fine structure constant $\alpha \sim \frac{q^2}{\hbar c}$. Nevertheless the coupling constant of the strong force will decrease, because it is inverse proportional to the energy and not the Planck constant alone $\alpha_s \sim \frac{1}{\ln(E^2)}$. J.Webb [5,6] was able to find evidence for the increase of $\propto$ in quasars. With the analysis of it's dipole characteristic it is even possible to measure the absolute velocity of our solar system in absolute space, despite the fact that the velocity of wave functions and the speed of light is constant for inertial reference systems. In this GTR model it is a necessity, while classical general relativity cannot give any explanation. Furthermore it is a bare contradiction of it's preconditioned equivalence principle under most simple transformations. Classical quantum theory in turn gives no evidence or any reason for an increasing or decreasing fine structure constant over time. The effect is also proven by measurements of $\alpha = 1/128$ in particle accelerators [7]. At velocities very close to the speed of light you will always get the $\propto$ increase, also now and here on planet earth.

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