Reference Frame Transformations and Quantization

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Abstract. It has been said that the theory of electromagnetic field as per Maxwell is "relativistic" as Einstein showed that these axioms of Maxwell are all Lorentz invariant. There are some issues regarding these "results" which we want to investigate. As usual, as we reckon that one of the causes of the utter confusion in the development of theoretical physics is rushing into the indoctrination instead of scientific discussion. We will question existing claims on this issue.

"Mozart, You are a god, and do not even know it." ... (Alexander Pushkin)
"To punish my contempt of authority, I became an authority." ... (Albert Einstein)

1. Transformations and Dynamics

One of the biggest and most fundamental question in relativity theory is what is "relativistic". Newton, an Orthodox theologian at Cambridge, assumed the absolute reference frame and defined relative motion as the difference of two absolute motion vectors to be observed from outside of the absolute frame. Galileo's idea was to reject the absolute frame and associate a reference frame to each body and let each body observe the other body's motion inside its own reference frame. Philosophically this idea was the reflection of the time when rejection by merchant class of the feudal absolute power system in Europe was taking place. This concept came with the restriction of "inertial reference frames", by which we mean reference frames which move with constant speed relative to each other inside each other. This condition was added when they discovered that accelerating reference frames do not share the same laws of physics. For example in the classical dynamics, by considering the mutually accelerating frames, we violate the action-reaction law. The condition of sharing the same laws of physics was taken as fundamental for relativity theory and is called the "Principle of Relativity".

To represent the motion of inertial reference frames, Galilean relativity theory introduced a naturally associated "spacetime" coordinate transformation called Galilean transformation.

$$\begin{aligned} t' &= t \\ x' &= x - vt \end{aligned}$$

where v is the relative speed between the two inertial frames involved. With this it was possible to restate the Principle of Relativity as "The laws of physics must be invariant under the Galilean transformation."

Already knowing that the adoption of inertial reference frames violates the Third Law (Action Reaction Law) of Newton's dynamics, a natural question is if the Second Law and the Law of

Gravity is invariant under the Galilean transformation. Curiously, this question was never considered. However, as we will present below, the answer is "yes" for Galilean transformation.

$$F = m\frac{d^2x}{dt^2} \quad \Longrightarrow \quad F = m\frac{d^2(x-vt)}{dt^2} = m\frac{d^2x}{dt^2}.$$

$$F = \frac{GmM}{(x_m - x_M)^2} \quad \Longrightarrow \quad F = \frac{GmM}{((x_m - vt) - (x_M - vt))^2} = \frac{GmM}{(x_m - x_M)^2}.$$

So, in the case of Galilean Transformation, the damage of relativization is limited to the loss of the Third Law.

Remark (1) *By identical argument we can show that the Coulomb force law is invariant under the Galilean transformation.*

To Galilean Relativity Theory, Einstein added an "extra" Axiom of Constancy of the Speed of Light, which claims that the speed of light is constant c in any inertial reference frames, in symbols $c + v = c$.[11] The result is what we now call the Special Theory of Relativity. The simplest and most effective refutation of this claim came from Anderton [1] of Natural Philosophy Alliance. He incisively pointed out that "if $c+v = c$ is true then c is not a speed." We presented an incisive argument to back up Anderton's argument. Assume that v is the absolute speed of Michelson-Morley apparatus in the absolute space. Even if $c + v$ is the absolute speed of the light moving towards the mirror, the effect of this cancels out because the mirror is also moving with speed v in the absolute frame. On the same token, though the reflected light moves with speed $c - v$ towards the emitter of light, as the emitter is moving with speed v, the effect of v cancels out. So, we will never detect this v. This came from the "ill fated" interpretation of Michelson-Morley experiment.

Thus, Einstein derived the so called Lorentz transformation in between two inertial reference frames. Before Einstein, Lorentz derived a coordinate transformation only in between the absolute aether frame and an observer's frame moving in the absolute frame, assuming that the length of a matter moving in the absolute frame contracts when it moves in the absolute frame, aka the "Lorentz-FitzGerald contraction".[20] Einstein generalized this result of Lorentz to the setting of arbitrary inertial reference frames without involving absolute frame. It goes as follows:

$$\begin{aligned} x\prime &= \frac{(x-vt)}{\sqrt{1-(v/c)^2}} \\ t' &= \frac{1}{\sqrt{1-(v/c)^2}}\left(t - \frac{vx}{c^2}\right). \end{aligned}$$

With this, Einstein rewrote the Principle of Relativity as "Laws of Physics must be invariant under the choice of inertial reference frames which later was taken as the invariance under the Lorentz transformations." Before this the Principle of relativity meant that the laws of physics must be invariant under the choice of inertial reference frames. (Though not specifically brought up explicitly, this implied that the laws of physics must be invariant under the Galilean transformations.)

Putting aside that this theory, as the extension of Galilean Relativity Theory, violates the Third Law, it is curious to find out what about the Second Law and the Law of Gravity. Clearly they fail to be invariant under the Lorentz transformation, as we have

$$F = m\frac{d^2x}{dt^2} \quad \Longrightarrow \quad F = m\frac{d^2}{dt^2}\frac{(x-vt)}{\sqrt{1-(v/c)^2}} \neq m\frac{d^2x}{dt^2}.$$

$$F = \frac{GmM}{(x_m - x_M)^2} \Longrightarrow F = \frac{GmM}{(\frac{(x_m - vt)}{\sqrt{1-(v/c)^2}} - \frac{(x_M - vt)}{\sqrt{1-(v/c)^2}})^2} = \frac{GmM}{(\frac{(x_m - x_M)}{\sqrt{1-(v/c)^2}})^2} \neq \frac{GmM}{(x_m - x_M)^2}.$$

This means that under Einsteinian relativisation all axioms of Newtonian dynamics except the first axiom of the Law of Inertia fail. The damage of relativisation is much bigger when we take Einsteinian relativisation over Galilean relativisation.

Remark (2) *Again, by identical argument we can show that Lorentz transformation fails to conserve the Coulomb's laws.*

2. Transformations and Electromagnetism

One of the major reason for the introduction of the Lorentz transformation was that Lorentz discovered that the electromagnetic wave equation of Maxwell is not invariant under the Galilean transformation. He discovered that a "better" coordinate transformation by himself, called Lorentz Transformation, preserves Maxwell's electromagnetic wave equation.[20] Einstein generalized this "promising" result by showing that under the Lorentz transformation all basic equations of Maxwell's electromagnetic field theory are invariant.[11] This became the vindication for the claim that Maxwell's electromagnetic field theory is relativistic in Einsteinian sense.

First, though wave equations are not conserved under the Galilean transformations, wave functions are transformed into wave functions through Galilean transformations. So, it is not quite clear if we needed Lorentz transformations to begin with. If the issue of relativity is just the changing of reference frames, then Galilean transformation is the most natural transformation representing the choice of inertial reference frames. The dominating argument for supporting the Lorentz transformation is twofold:

(i) Lorentz transformation maps electromagnetic wave equations into electromagnetic wave equations while Galilean transformations fail to do so. To this the right response is that wave mechanics and particle mechanics are entirely different theories covering entirely different issues of physics. Galilean transformation came from the consideration of relativising particle kinematics. It is totally expected that this transformation does not deal with physical waves, which exist upon continuum wave mediums. In wave mechanics, it is not particles which move in the direction of the wave. It is the localized vibration energy of the medium which moves. For this reason, wave mechanics has no naturally associated momentum, which is the product of speed and mass. The hypothetical momentum of waves came from the ill-fated relativistic theory of waves as per de Broglie.[8]

(ii) Lorentz transformation conserves Maxwell's electromagnetic equations into equivalent equations. We will discuss later the issue of whether Galilean transformations do the same.

Maxwell reduced the entire electromagnetic theory to the following field plus current equations:

$$\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}, \quad \nabla \cdot \mathbf{E} = 4\pi\rho, \quad \nabla \cdot \mathbf{H} = 0, \quad \mathbf{J} = \rho\mathbf{v}, \quad \nabla \times \mathbf{H} = \frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial}{\partial t}\mathbf{E}$$

where $c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$. Here ρ is electric charge density and $\mathbf{J}$ is the current called "conducting current" created by the charge density moving with speed $\mathbf{v}$. Maxwell obtained the last equation, called "Generalized Ampère's Law", under the assumption that the charges in $\mathbf{J}$ move with constant speed $\mathbf{v}$. Later this restriction was removed.

This introduction of $\mathbf{J}$ into the field theory is problematic. According to the definition of electric force field, charges placed in the field will not affect the field, meaning that the charges placed will not affect other charges which create the electric field.

Ontologically, it is hard to understand **J** at this basic level. How is it possible that mutually repelling electrons can form a coherent bundle? Their answer is inside a conductor. But, here is a vicious circularity. Conductors are objects to be studied in material science in which we have to use electromagnetic theory. This problem somehow resembles the problem of tension rope in classical dynamics. It is supposed to be a massless entity which moves under acceleration. Then it must be the case that all such ropes will move with infinite speed. How does it connect two bodies? It is a serious problem that in theoretical physics this kind of conceptual compromise is everywhere leading us to utterly compromised theories.

Here is yet another consequence of the logical inconsistency discussed above of Maxwell's electromagnetic field theory. Maxwell obtained the electromagnetic wave equation

$$\nabla^2\mathbf{E} = \frac{1}{c^2}\frac{\partial^2\mathbf{E}}{\partial^2 t} \qquad \text{and} \qquad \nabla^2\mathbf{H} = \frac{1}{c^2}\frac{\partial^2\mathbf{H}}{\partial^2 t}.$$

under the condition that $\mathbf{J} = 0$ (meaning no conducting current). From this wave equation, he calculated the speed of electromagnetic wave in vacuum as $c = 1/\sqrt{\varepsilon_0\mu_0}$. Curiously, he also showed that electromagnetic waves are created by accelerating charges. But do accelerating charges not constitute a current? According to the mathematical definition of current, maybe Maxwell did not notice, but even a singular moving charge is a current. In fact, radio engineers say that when we have a circular closed circuit conducting electrons inside, it produced electromagnetic wave and one cycle of the electron is the cycle of the produced electromagnetic wave. This is because electrons in the circuit are under centripetal acceleration.

Lorentz was motivated when he found out that the Galilean transformation of the em wave equations are not wave equation. This lead him to try his own Lorentz transformation instead and he showed that the Lorentz transformation maps electromagnetic wave equation to electromagnetic wave equation.

Remark (3) *This "claim" is to be refuted later in* ***Section 6*** *however.*

This formed a base for the claim that "Galilean transformation is invalid and should be replaced by Lorentz transformation." despite all other problems Lorentz transformations create, some of which we discussed in the previous section.

3. Transformation of Waves v.s. Transformation of Wave Equations

However, this hasty argument should be reconsidered due to the following legitimate argument: The wave equation in one dimension without sources for speed v is

$$\nabla^2\phi = \frac{1}{k}\frac{\partial^2\phi}{\partial^2 t}.$$

It is well known that when we Galilean transform this equation the result is not a wave equation anymore.

The general solution of this wave equation is

$$\phi(x,t) = \psi_+(x-kt) + \psi_-(x+kt).$$

The first term is a wave propagating with speed $+k$, and the second one with $-k$. The Galilean transformation transforms this general solution to

$$\phi(x,t) = \psi_+(x-(k+v)t) + \psi_-(x+(k-v)t).$$

This is a superposition of two waves and so it is a wave. This wave has a different speed from the original wave. But is it not expected due to the Galilean transformation?

We can support this argument using Fourier expansion too. A sinusoidal wave transforms into sinusoidal wave. So, a Fourier expansion which describes a wave also transforms into a Fourier series which represents a wave.

However, when we Lorentz transform a wave function, we do not get a wave function in general. For example it is known well that sinusoidal wave will be transformed into a sinusoidal wave by Lorentz transformation "if" the wave amplitude is the solution of a wave equation which is invariant under the Lorentz transformation.

For this reason, relativistic theory of waves "assumes" that the wave equations are invariant under the Lorentz transformation. Under this assumption, we have the invariance "under Lorentz transformation" of the phase of a plane wave

$$\mathbf{k}' \cdot \mathbf{r}' - \omega' t' = \mathbf{k} \cdot \mathbf{r} - \omega t$$

where $\mathbf{k}$ is the wave vector, $\mathbf{r}$ is a position vector and ω is the frequency. With this invariance, we get the following relativistic wave transformation equations:

$$\begin{aligned} k'_x &= \frac{1}{\sqrt{1-(v/c)^2}}\left(k_x - v\frac{\omega}{c^2}\right) \\ k'_y &= k_y \\ k'_z &= k_z \\ \omega' &= \frac{1}{\sqrt{1-(v/c)^2}}\left(\omega - vk_x\right). \end{aligned}$$

So it is very clear that the theory of Lorentz transformation of waves has been not as universal as the public have been told. It applies only to the waves that are invariant under the transformation. And we were told that electromagnetic waves are such examples. Clearly it has the same kind of deficiency as the Galilean transformation of waves, if not worse.

Remark (4) *It is clear that the phase* $\mathbf{k} \cdot \mathbf{r} - \omega t$ *is Galilean invariant for any wave.*

Remark (5) *We will show later in* ***Section [6]*** *that, contrary to what has been claimed by Lorentz and Einstein, Lorentz transformations will not conserve any of wave equations, electromagnetic or non-electromagnetic.*

Things get more "spectacular" as de Broglie used this transformation of "relativistic" waves and Einstein's relativistic theory of photons to create a relativistic wave-particle duality. Observing an analogy between the above discussed relativistic wave transformation and the relativistic transformation of energy and momentum:

$$\begin{aligned} p'_x &= \frac{1}{\sqrt{1-(v/c)^2}}\left(p_x - v\frac{E}{c^2}\right) \\ p'_y &= k_y \\ p'_z &= k_z \\ E' &= \frac{1}{\sqrt{1-(v/c)^2}}\left(E - vp_x\right). \end{aligned}$$

applied to the relativistic theory of photons

$$E = hf = pc = 0/0 \qquad p = h/\lambda$$

where λ is the wave length, de Broglie obtained the following relativistic equation for relativistic waves:

$$\mathbf{p} = \hbar\mathbf{k} \qquad E = \hbar\omega.$$

This is how the controversial wave-particle duality of Quantum Mechanics was introduced.

It was unfortunate that all of this was done without noticing the following fatal contradiction coming from the relativistic theory of photons:

$$E = \sqrt{(cp)^2 + (m_0)^2c^4} = cp = \frac{m_0vc}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} = \frac{0}{0}cv = c^2hf = hf.$$

The reason why electromagnetic wave equations are invariant under the Lorentz transformations is simply because Lorentz transformations are transformations obtained within the context of Maxwell's electromagnetic field theory.

Moreover, as we have shown above, Lorentz Transformation fails to map axioms of Newton Dynamics into axioms of Newton Dynamics. What does this mean? A naturally expected answer is that the concept of relativity is not applicable to dynamics as it violates the Action Reaction Law. But as we have seen in the first section, Galilean transformation which also is a coordinate transformation associated with inertial reference frames, conserves the second law and the gravitational law. The only deficiency of the Galilean transformation we know of is that it violates the Third Law.

This should mean that Lorentz transformations are more problematic than Galilean transformations though both of them are invalid as they are mathematical representations of the invalid concept of relatively moving reference frames which violate the Third Law.

However, in practice, in most cases of dynamics around us, we can assume that one mass is way to large to be able to ignore the reaction on it from the smaller mass, and so, the conservation of the second law and gravitational law is enough to have reasonable approximation. The action-reaction problem becomes important when we consider the astronomical scale masses under gravitational acceleration.

Remark (6) *There is yet another problem with all of these apparently impressive discussions. It is a tradition of pure mathematics and logic to make sure that it is properly understood that a result must be always accompanied with restrictions imposed on the derivation of it. Coordinate transformations are applicable only to inertial frames. No accelerating frames should be transformed. Yet in the discussion of transformation of waves we are completely forgetting that physical waves come from acceleration. This type of errors appear in many places in theoretical physics, unfortunately. For example the well tested concept of centrifugal force comes from the abusive use of a reference frame of an orbiting body.*

4. Lorentz Transformation and Speed c

Then what does it mean that Einstein proved that all axioms of Maxwell's em field theory are Lorentz invariant? This is because this transformation was built only for em field theory by Lorentz as a "solution" to the problem Michelson-Morley threw in to the theory of electromagnetic fields. That c is the speed of light wave which is electromagnetic wave in other reference frame gave an advantage. "In other theories of physics where the speed of light is not the issue, it is hard to imagine that this c will play the role it played in the Maxwell's electromagnetic field theory." So, it is not a surprise at all that Lorentz transformation fails to preserve the Law of Gravity and the Second Law of Classical Dynamics. It indeed is a surprise that 20th century theoretical physicists thought that the invariance under the Lorentz Transformation should hold for any acceptable theories of physics. That this wishful thinking became the indoctrination is a clear evidence which supports the view that the 20th century theoretical physics was reduced to a religious cult.

Maxwell's em field theory is incomplete to describe the electrodynamics. Electrodynamics assumes classical dynamics as an underlying theory. This part was omitted by Maxwell and his

followers. Everybody assumed it without being aware of it. All charges have mass as we all know.

This surfaced explicitly in Lorentz force but nobody paid attention to this hidden problem. Lorentz force, which depends also upon the speed, contradicts the second law, which asserts that the force should be dependent upon only acceleration, not on speed.

On the one hand the Galilean Transformation preserves the Second Law and the Gravitational Law, and on the other hand Lorentz Transformation fails to do so. This important fact was never noticed. There is nothing technically difficult here. This simple but important and devastating fact just did not occur to the elitistic physicists community.

Einstein got into some problems in showing the invariance of all axioms of Maxwell under the Lorentz Transformation. Some of the axioms had to be translated into "equivalent" ones. This is rather expected. The problem is that **J** is not a force field. It is a different monster which was questioned when Maxwell put it in his axiomatic theory of electromagnetic fields. **J** is defined in terms of **v**. Lorentz transformation has a problem with transforming **v**, more specifically, relativistic addition of speeds. As discussed in our Relativistic Geometry paper, the argument goes as follows:

Assume three inertial frames $F1$, $F2$ and $F3$. Let v and $v\prime$ be the mutual speed between $F1$ and $F2$, and $F2$ and $F3$, respectively. As these speeds are used to define the gamma factor, at the pain of vicious circle, they must be pre-relativistic speeds, i.e. classical speeds. So, $v + v'$ is the mutual speed between $F1$ and $F3$.

The Lorentz Transformation L between $F1$ and $F3$ is defined as

$$x' = \frac{(x - (v + v')t)}{\sqrt{1 - (v + v')^2/c^2}}, \quad y' = y, \quad z' = z, \quad t' = \frac{\left(t - \frac{(v+v')x}{c^2}\right)}{\sqrt{1 - (v + v')^2/c^2}}.$$

Let L and L' be Lorentz transformations from $F1$ to $F2$, and from $F2$ to $F3$

$$x' = \frac{(x - vt)}{\sqrt{1 - v^2/c^2}}, \quad y' = y, \quad z' = z, \quad t' = \frac{\left(t - \frac{vx}{c^2}\right)}{\sqrt{1 - v^2/c^2}}.$$

$$x" = \frac{(x' - v't')}{\sqrt{1 - (v')^2/c^2}}, \quad y" = y', \quad z" = z', \quad t" = \frac{\left(t' - \frac{v'x'}{c^2}\right)}{\sqrt{1 - (v')^2/c^2}}.$$

respectively. It is clear that $L \neq L' \circ L$ where $L' \circ L$ is the mathematical composition of L and L'.

Mainstream physicists contest saying that in special theory of relativity, calculating $v + v'$ is the wrong thing to do. They claim that this should be replaced by the relativistic addition (transformation) of speed

$$v \oplus v' = \frac{v - v'}{1 - vv'/c^2}.$$

This is to say that L should be

$$x" = \frac{(x - (v \oplus v')t)}{\sqrt{1 - (v + v')^2/c^2}}, \quad y" = y, \quad z" = z, \quad t" = \frac{\left(t - \frac{(v\oplus v')x}{c^2}\right)}{\sqrt{1 - (v + v')^2/c^2}}.$$

When we ask why $v + v\prime$ is not replaced by $v \oplus v'$ in the gamma factor, they have no answer. Also we have a problem with $(v \oplus v')$ in the Lorentz transformation as Lorentz transformation is the agent to introduce relativity concept and one can not use already relativistic concept $v \oplus v'$ to define such transformation. This is a conceptual vicious circularity which mathematicians

and logicians reject. They just say "but it works for composing Lorentz Transformations". Unfortunately this version of L still "fails" $L = L' \circ L$. Mathematically, Lorentz transformations are linear transformations from 4D space to itself. So, it is highly irregular that algebraic composition of such transformations is not the desired transformation.

Conceptually, $(v + v')$ is classically measured speed. The reason why $(v \oplus v')$ was introduced in the numerator part is because classical addition $(v+v')$ does not work for relativistic addition of speed. As the relativistic addition $(v \oplus v')$ is introduced by relativistic argument, it is viciously circular to use this relativistic version in the gamma factor. After all even if we close our eyes to this vicious circularity the end result we are to observe makes no difference.

Moreover, mathematically we have a problem too. It is naturally expected that $x"/t"$ will serve as the observed speed $v \oplus v'$. There is no way to prove that they are equivalent. Here is a simple calculation which leads to this conclusion.

$$\frac{x"}{t"} = \frac{(x - (v \oplus v')t)}{\left(t - \frac{(v \oplus v')x}{c^2}\right)} = \frac{c^2(x - (v \oplus v')t)}{c^2t - (v \oplus v')x} = \frac{c^2x - c^2(v \oplus v')t}{c^2t - (v \oplus v')x.}$$

Note that even if we replace the classical $v + v\prime$ in gamma factor with relativistic $v \oplus v'$, the above calculation holds.

Now assume that

$$\frac{c^2x - c^2(v \oplus v')t}{c^2t - (v \oplus v')x.} = v \oplus v'.$$

Then we have

$$\begin{aligned} c^2x - c^2(v \oplus v')t &= (v \oplus v')(c^2t - (v \oplus v')x. \\ c^2x &= 2c^2(v \oplus v')t - (v \oplus v')^2x \\ c^2x + (v \oplus v')^2x &= 2c^2(v \oplus v')t \\ \frac{x}{t} &= \frac{(v \oplus v')^2}{c^2 + (v \oplus v')^2}. \end{aligned}$$

There is no reason for this to be true.

Empirically speaking, even though it could be possible to measure v, what about $v\prime$? It is next to impossible to measure $v + v\prime$, is it not? If v is a speed of a star A moving away from us in distance and if $v\prime$ is a speed of another star B moving away from A, then how can we measure the $v\prime$ and so $v + v\prime$?

In case of axioms of electromagnetic fields, there is no $\mathbf{v}$ involved and this is why there was no difficulty in the invariance of the field equations of Maxwell.

Despite all of this, there are some positive results concerning the transformation of wave equations. Unlike Galilean transformation, Lorentz transformation maps em wave equation into em wave equation. The reason why is simple. This transformation assumes that the "constant" c is the speed of light in any inertial reference frame.

Remark (7) *Again, this over-optimistic claim is false. As we will see later in* ***Section 6****, the claim that Lorentz transformations map wave equations into wave equations is false even for electromagnetic wave equations.*

5. Is Schrödinger Wave Equation Relativistic?

5.1. De Broglie Relation

De Broglie obtained the following relativistic transformation of a plane wave for a wave which is invariant under the Lorentz transformation (we call it a "relativistic wave"):

$$k'_x = \frac{1}{\sqrt{1 - (v/c)^2}}\left(k_x - v\frac{\omega}{c^2}\right), \quad k'_y = k_y, \quad k'_z = k_z, \quad \omega' = \frac{(\omega - \nu k_x)}{\sqrt{1 - (v/c)^2}}$$

where $\mathbf{k} = (k_x, k_y, k_z)$ is the wave vector and ω is the frequency. We denote the wave number $|\mathbf{k}|$ by k. So, $k = |\mathbf{k}|$. This restriction to "relativistic waves" is in place because otherwise the wave phase $\mathbf{k} \cdot \mathbf{r} - \omega t$ would not be invariant under the Lorentz transformation. Using the analogy between this and the momentum-energy transformation

$$p'_x = \frac{1}{\sqrt{1-(v/c)^2}}\left(p_x - v\frac{E}{c^2}\right), \quad p'_y = p_y, \quad p'_z = p_z, \quad \omega' = \frac{(E - \nu p_x)}{\sqrt{1-(v/c)^2}}$$

where $\mathbf{p} = (p_x, p_y, p_z)$ is the momentum vector and E is the energy, de Broglie "proposed" the following association between a particle and a wave (called matter wave):

$$\mathbf{p} = \hbar\mathbf{k} \quad E = \hbar\omega$$

where $\hbar$ is a constant. We call this de Broglie relation. Though this resembles Einstein's particle-wave duality

$$E = hf = pc \quad p = h/\lambda$$

where λ is the wave length, there is a fundamental difference.

There are several issues to be discussed.

(i) Unlike the photon-light duality where the speed of photon and that of light are equal, the phase speed of matter wave and the speed of particle can be different.

(ii) De Broglie further "assumed" that, associated with a particle with speed V, was a wave having "phase speed" $w = \omega/k$. This association requires more explanation.

(iii) He also assumed that the energy in the wave traveled along with a group speed $v_g = d\omega/dk$, which was identical to the particle's speed V. Here it is not quite clear what did he mean by "energy" in the wave. The so called de Broglie relation above is nothing but a wild hypothesis based upon just the above mentioned "analogy" of "wave vector-frequency" transformation and "momentum-energy" transformation. Certainly this does not yield the concept of "energy in the wave".

Anyhow, de Broglie assumes that $c^2(\omega/c^2 - k^2)$ is invariant under the relativistic transformation as an "analogy" to the relativistic invariance of $c^2(E/c^2 - p^2)$. So,

$$c^2(\omega/c^2 - k^2) = constant = C.$$

From this, it follows that

$$2\omega/c^2\frac{d\omega}{dk} - 2k = 0.$$

This leads to

$$v_g = \frac{d\omega}{dk} = \frac{c^2 k}{\omega}.$$

As the phase speed is $w = \omega/k$, we have

$$v_g = \frac{c^2}{w}.$$

It now follows that either phase speed w or group speed v_g could exceed c but not both. We do not know what this means for Special Theory of Relativity, which asserts that nothing moves faster than speed c.

All of this "mathematical nicety" is relative to the "*analogy-based hypothesis*" that a particle with speed v has a wave dual called matter wave whose group speed is v_g and whose phase speed is $w = \omega/k$. A particle in motion carries energy and so it is expected that the wave dual

of this particle also carries energy of the same amount if the energy conservation law is to be respected. But according to wave mechanics, for a wave to carry energy it has to have wave medium. A concern we have is that de Broglie's wave is a mathematical wave that appears to have no wave medium, just like that electromagnetic wave carries energy without having wave medium. We have already pointed out that electromagnetic field which carries electromagnetic waves is a fiction, counter-factual modality which plays no ontological role in physics. So, what happened to the energy issue of the matter wave? This is not the case with de Broglie waves.

However, it is not clear at all why we have to choose Lorentz transformed version over Galilean transformed version. At best, that the Galilean Transformation of wave functions are wave functions, seems to suggest that the theory of Lorentz Transformation of wave functions is rather self-serving. That Lorentz Transformation came from Time Dilation and Length Contraction which causes paradoxes (contradictions), seems to suggest that there are more fundamental things which have to be reexamined in this "self-serving" theory of Lorentz Transformations. Indeed, almost all waves wave mechanists work on are not relativistic at all. The only familiar waves which are relativistic are electromagnetic waves. But this is over shadowed by the fact that electromagnetic theory which gave birth to electromagnetic waves is not relativistic at all. The most basic axioms of this theory, the Coulomb's laws, are not relativistic as we established above. So, that electromagnetic waves are relativistic strongly suggests that the theory of electromagnetism is inconsistent.

Remark (8) *To add salt to the injury, as we will see later in* ***Section 6****, the claim that Lorentz transformations map wave equations into wave equations is false even for electromagnetic wave equations.*

5.2. Schrödinger's Wave Equation

Schrödinger used Hamilton's energy dynamics for the particle theory and applied de Broglie's pilot wave theory to produce a wave-particle duality which looks after the energy issue of de Broglie's relation.[26][8]

All waves propagated along the x-axis obey the following wave equation

$$\frac{\partial^2 \Psi}{\partial x^2} = \frac{1}{\omega^2}\frac{\partial^2 \Psi}{\partial t^2}$$

where $\Psi(x,t)$ is the wave function and ω is the wave speed.

Here, we consider the wave function Ψ whose square yields the probability of locating a particle at any point in the space. We consider only systems whose total energy E is constant and whose particles move along the $x-$axis and are bound in space. Then the frequency associated via "de Broglie relation", which is totally hypothetical and relativistic, with the bound particle is also constant, and we can take the wave function $\Psi(x,t)$ to be

$$\Psi(x,t) = \psi(x)f(t).$$

As the frequency is assumed to be precisely defined,

$$f(t) = \cos 2\pi\nu t.$$

So, we have

$$\frac{\partial^2 \psi}{\partial x^2} = -\left(\frac{2\pi}{\lambda}\right)^2 \psi = -\left(\frac{p}{h}\right)^2 \psi$$

where the wave length is $\lambda = \omega/\nu$ and the momentum of the particle is $p = h/\lambda$.

We take the particle of mass m to be interacting with surroundings through a potential-energy function $V(x)$. The total energy of the system is given by

$$E = E_k + V = \frac{p^2}{2m} + V$$

where E_k is the kinetic energy of the particle. Then we have

$$p^2 = 2m(E - V)$$

and we have

$$\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + (E - V)\psi = 0.$$

So,

$$-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + V\psi = E = i\hbar\frac{\partial\psi}{\partial t}.$$

This equation is called (non-relativistic) Schrödinger wave equation as the energy equation involves non-relativistic mass m and it is not invariant under the Lorentz transformation. This does not mean that Quantum Mechanics is a non-relativistic theory. The derivation of Schrödinger wave equation involved de Broglie relation which is nothing but a relativistic theory.

Nevertheless, Schrödinger knew this problem and he tried to make his wave equation relativistic, without success. This problem was "resolved" by Gordon-Klein-Dirac in the development of the Quantum Electrodynamics.

Remark (9) There is a typical sloppy argument sticking out its ugly head here again. On the one hand, they say

$$\frac{\partial^2\Psi}{\partial x^2} = \frac{1}{\omega^2}\frac{\partial^2\Psi}{\partial t^2}$$

is the wave equation and as an example of it they present

$$-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + V\psi = E = i\hbar\frac{\partial\psi}{\partial t}.$$

This obviously becomes a wave equation only when $V = 0$.

As pointed out above, Schrödinger's so-called wave equation is in fact not a wave equation as it is irreconcilable with the classical equation for waves. A further observation of the form indicates similarities between Schrödinger's equation and the diffusion equation used in describing density fluctuations in materials due to diffusion. The diffusion equation is given as

$$\frac{\partial\phi(x,t)}{\partial t} = \nabla D(\phi, x)\phi(x,t)$$

where $\phi(x,t)$ is the density of the diffusing material at position x and time t, and $D(\phi, x)$ is the diffusion coefficient for density ϕ at position x. When D is constant, the equation reduces to

$$\frac{\partial\phi(x,t)}{\partial t} = D\nabla^2\phi(x,t).$$

which is a partial differential equation with first derivative in time and second derivative in position, just like the Schrödinger's equation. This particular form of diffusion equation was proposed by Fourier in 1822 to describe the heat distribution in a given region of a material over a particular time and hence is sometimes referred to as "heat equation".[13]

A crucial difference between the Schrödinger equation and the diffusion equation is that the coefficient in the latter (D) is real, while in the former it is complex. Consider for instance the equation for a free particle:

$$\frac{\partial\psi(x,t)}{\partial t} = \frac{i\hbar}{2m}\nabla^2\psi(x,t).$$

This difference makes the solutions to the diffusion equation decay with time (gradient), while the solutions to the Schrödinger's equation oscillate (wave). Note however that originally, before the Born interpretation became common, Schrödinger attempted to interpret the wavefunction as electronic charge distribution in space (with charge density at position x and time t proportional to $|\psi|^2$): "the charge of the electron is not concentrated in a point, but is spread out through the whole space [...] the charge is nevertheless restricted to a domain of, say, a few Angstroms, the wavefunction ψ practically vanishing at greater distance from the nucleus."[26] This would suggest his treatment of charge density as having a character of a radiation, indicating certain gradient properties.

It is unfortunate that the name "wave equation" became the going name for Schrödinger's equation thereby confusing the classical wave equation with a formalism lacking grounding in ontology. It appears that the Schrödinger's equation is an attempt at merging the concept of wave-particle duality with the treatment of electronic charges in terms of density distribution. Regarding the former, Schrödinger himself had reservations assuming the veracity of matter waves, justifying the concept by stating that neglecting de Broglie's waves leads to serious difficulties in atomic mechanics. Regarding the latter, Schrödinger himself noticed that this interpretation of wavefunction does not work for systems of multiple electrons.[27]

Nevertheless, Schrödinger knew this problem and he tried to make his wave equation relativistic without success. This problem was "resolved" by Gordon-Klein-Dirac in the development of the Quantum Electrodynamics.

With all of this, it is clear now why Schrödinger failed to show that his wave equation for particles is relativistic. To make the matter even worse, nobody in theoretical physics understood that as Schrödinger's equation is not relativistic, the quantization of such equation is impossible because de Broglie's quantization of waves worked only for relativistic waves.

Unfortunately, this means pulling carpet from under Quantum Mechanics. The "answer" of theoretical physicists to this error, which they recognized not as a "fatal error" but as a "technical difficulty", was the infamous "Gordon-Klein equation". Instead of relativising Schrödinger's wave equation, they quantized relativistic energy-momentum equation of Einstein by replacing "energy variable" and "momentum variable" with "quantum energy operator" and "quantum momentum operator". Unfortunately, this does not make the Schrödinger wave equation relativistic and compensate for the deficiency stated above.

Remark (10) *To make the matter even worse, the energy-momentum relation is a consequence of the relativistic energy equation $e = mc^2$ which is false. Here m is the relativistic mass $m_0/\sqrt{1-(v/c)^2}$which is obtained through a thought experiment that assumed that v is constant. With this Einstein obtained relativistic Second Law $P = mv$. By taking a time derivative, he then obtained the relativistic second law $F = dP/dt = vdm/dt+mdv/dt$. This lead him to conclude $e = mc^2$. Unfortunately, he forgot that v is constant, which leads to $e = 0$. This has an absolutely devastating effect of killing the entire theoretical physics of the 20th century. As Einstein said, if $e = mc^2$ fails, the entire modern physics fails. This is a secondary school level mathematical error and it is astounding that the entire community of physicists who have the nerve to call themselves the King failed to notice this. Too much prestige and power got into their rather simple brain.*

Dirac took advantage of this Gordon-Klein equation and derived "relativistic theory of electrons" which yielded the "positron" and opened a gate to the so called Quantum Electrodynamics which is supposed to be the most successful theory of physics in history.

6. Are Wave Equations Really Relativistic?

Now we have reached to the point where we have to ask if the so-called wave equations really represent waves which appear in physics correctly. One more question is if the so called Lorentz transformation which "apparently" maps electromagnetic wave equations to electromagnetic wave equations do so with ontological background.

For the first argument the reasoning is such that the Galilean transformation fails to conserve electromagnetic wave equations and the Lorentz Transformation conserves electromagnetic wave equations. It seems to be the only reason why Lorentz transformation replaced Galilean transformation and Galilean relativity theory was condemned (except the faulty interpretation of the Michelson-Morley experiment) was that it failed to map electromagnetic wave equations to electromagnetic wave equations. So, we can safely say that as far as the wave theory is concerned, it was the failure to conserve electromagnetic wave equations which dethroned the Galilean transformation.

The first question on this hasty conclusion is whether the wave equations are the basic axioms of physical theories. Clearly not. They are the product of the basic axioms under certain circumstances. So, logically there is no convincing reason why such secondary equations must be conserved under the coordinate transformations.

But to make the argument more articulate, let us discuss the issue under more general situations.

$$\begin{aligned}\frac{\partial\psi(x',t')}{\partial x} &= \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial x'}{\partial x}+\frac{\partial\psi(x',t')}{\partial t'}\frac{\partial t'}{\partial x}\\ &= \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial\gamma(x-vt)}{\partial x}+\frac{\partial\psi(x',t')}{\partial t'}\frac{\partial\gamma(t-\frac{vx}{c^2})}{\partial x}\\ &= \gamma\frac{\partial\psi(x',t')}{\partial x'}-\frac{\gamma v}{c^2}\frac{\partial\psi(x',t')}{\partial t'}\end{aligned}$$

Similarly,

$$\frac{\partial\psi(x',t')}{\partial t} = -\gamma v\frac{\partial\psi(x',t')}{\partial x'}+\gamma\frac{\partial\psi(x',t')}{\partial t'}$$

Then,

$$\begin{aligned}\frac{\partial^2\psi(x',t')}{\partial x^2} &= \left(\gamma\frac{\partial}{\partial x'}-\frac{\gamma v}{c^2}\frac{\partial}{\partial t'}\right)\left(\gamma\frac{\partial}{\partial x'}-\frac{\gamma v}{c^2}\frac{\partial}{\partial t'}\right)\\ &= \gamma^2\frac{\partial^2}{\partial x'^2}-2\frac{\gamma^2 v}{c^2}\frac{\partial^2}{\partial x'\partial t'}+\frac{\gamma^2v^2}{c^4}\frac{\partial^2}{\partial t'^2}\end{aligned}$$

And similarly,

$$\frac{\partial^2\psi(x',t')}{\partial t^2} = \gamma^2v^2\frac{\partial^2}{\partial x'^2}-2\gamma^2v\frac{\partial^2}{\partial x'\partial t'}+\gamma^2\frac{\partial^2}{\partial t'^2}$$

With this, the wave equation now becomes

$$\gamma^2\frac{\partial^2}{\partial x'^2}-2\frac{\gamma^2v}{c^2}\frac{\partial^2}{\partial x'\partial t'}+\frac{\gamma^2v^2}{c^4}\frac{\partial^2}{\partial t'^2}=\frac{1}{\omega^2}\left(\gamma^2v^2\frac{\partial^2}{\partial x'^2}-2\gamma^2v\frac{\partial^2}{\partial x'\partial t'}+\gamma^2\frac{\partial^2}{\partial t'^2}\right).$$

This is valid only under the condition $v=c=\omega$. The second equality comes from that ω is the wave speed. The first equation implies that the frame speed is c which is not possible in Special Theory of Relativity. This means that Einstein's claim that the electromagnetic wave equation

is invariant under the Lorentz transformation is invalid. It is a well "understood" fact that there is no reference frame for light at the pain of contradiction. In the frame of light, light travels with c and so it will be observed from other frames that the light is moving with speed $2c$.

Conclusion (1) *Lorentz transformation fails to conserve all wave equations including electromagnetic wave equations.*

Conclusion (2) *Lorentz transformation serves no purpose one can imagine. It fails the conservation of the third law, that of the second law, that of gravitational law, that of Coulomb's law. Now we know it does not conserve even electromagnetic wave equations contrarily to the claim that this claimed conservation makes Relativity theory more appropriate that Galilean relativity theory. Naturally it does not conserve wave functions either.*

Conclusion (3) *All of this is a totally natural consequence of the wrong interpretation of Michelson-Morley's experiment. As we showed elsewhere, Michelson-Morley experiment showed that we can not detect v in $c + v$ in the way we measure the speed of light. So all of this catastrophic collapse of modern physics started from this Michelson-Morley experiment. The consequence is that the entire modern physics is shown to be nothing but pure fallacy.*

Contrary to that, Galilean transformation conserves all of the basic laws and constructs of physics except the third law and the wave equation. The only issue with this transformation is that it is based upon the faulty concept of moving reference frames. To explain this, assume a train runs on a track. When the tip of the train's power pole touches the power line at point A, spark occurs at A. An observer located in the train straight down from the tip A of the power pole will observe that this light comes straight down to him from this point A. But as this point A also is a stationary point of the power line, he will also observe that the light reaches him diagonally from this point A on the power line.[17]

Mathematically this problem can be explained as follows: in Geometry we can not move any point in geometric spaces as doing so breaks the metric structure of geometric spaces. One can not move a point 5 to the position of point 3 and vice versa as this breaks the metric topology of the real number line. This is why Newton did not move any geometric point. Instead he reduced a physical body to a point body and moved it inside a geometric space. If we can not move even a single point in a geometric space, how can we move the entire space itself inside other space. If we move a point 5 on a real line then what is the function that describes such motion?

Topologist René Thom said there is no point in geometry. In geometry we must assume that mysterious linear ordering among real points. This makes the geometry a continuum. Mathematical logician (the founder of model theory) Abraham Robinson expressed this in terms of infinitesimals. Points are all glued together by invisible infinitesimals. In the end, standard real analysis and infinitesimal calculus do the same thing.

7. Relativistic Transformations and 4D Spacetime

A motion in the 3D space is a function $f(t) = (x, y, z)$. This can be expressed as a line graph in the 4D spacetime. If the speed of the motion is constant, the graph is a straight line and if it is under acceleration, then the graph is a curved line. When we apply a Galilean transformation to this graph, then the resulting graph is a translated line.

$$f(t) = (x - vt, y, z).$$

However, when we apply Lorentz transformation to this graph, due to the time dilation and length contraction combined, the resulting graph becomes totally incomprehensible. So, the resulting graph is unusable for the purpose of physics. In symbols, the resulting "motion"

becomes the graph of

$$f\left(\frac{1}{\sqrt{1-(v/c)^2}}\left(t-\frac{vx}{c^2}\right)\right)=\left(\frac{1}{\sqrt{1-(v/c)^2}}\left(x-vt\right),y,z\right).$$

This is totally expected as under the Lorentz transformation time and space coordinate are interdependent. No mathematician with proper training will venture into this kind of "anti-mathematics" or "total mathematical nonsense".

8. Dirac's Aether Theory

As we can see in the vortex theory, which we will discuss in the next section, the whole philosophy of aether theory is to "squeeze out" particles from continuum. At the most fundamental level, as the French topologist René Thom pointed out, this is impossible as it destroys the topology of the continuum. The difficulty the classical aether theorists had is naturally expected because of this nature of continuum.

Dirac was the first who managed to "create" this paradigm upon the quantum field which is the quantization of classical field using the mathematical tool of Fourier expansion.[10] In this method, he did not create a geometric point as the quanta. He created a finite approximation of infinite Fourier expansion as a particle. So, his particles are infinitary objects described by waves.

All of this grand project started with a new theory of photons, Planck's "theory" of photons, which Planck himself did not take seriously and presented as a pure mathematical convention coming from graph fitting as the last resort to resolve the mystery of the blackbody radiation. He presented an argument that if we accept that the minimum energy carried by the electromagnetic wave is hf, where f is the frequency of the wave and h is a constant, which is now called the "Planck constant", the infamous blackbody radiation problem is resolved. So, he proposed that the light wave of frequency f carries waves as nhf, where n is a natural number.

Under the assumption that the speed v of light in vacuum "without conducting current" is constant c, which came from Maxwell's theory of electromagnetism, Einstein concluded that the mass of Planck's particle (photon) must be 0 to avoid the relativistic energy

$$e=mc^2=\frac{m_0}{\sqrt{1-(v/c)^2}}c^2$$

of photon become undefined (or diverge) where m is the rest mass of the photon. With this yet another convention the energy equation for photon becomes

$$e=0/0=hf.$$

Einstein wrongly thought that "as $0/0$ can be any number this equation is justifiable."

Remark (11) *Einstein thought as* $0/0$ *is equivalent to* $0x=0$*, and for the latter* x *can be any number,* $0/0$ *can be any number and he chose it to be* hf*. The former involves division by* 0*, which is not allowed, and the latter does not involve it.*

Unfortunately as discussed above and many other places, this leads to yet another contradiction. The relativistic energy equation $e=mc^2$ leads to the famous relativistic energy-momentum relation $e=\sqrt{(cp)^2+(m_0c^2)^2}$which in turn leads to the following contradiction

$$e=\sqrt{(cp)^2+(m_0)^2c^4}=cp=\frac{m_0vc}{\sqrt{1-\left(\frac{v}{c}\right)^2}}=\frac{0}{0}c^2=c^2hf=hf.$$

Logically speaking the real problem with the Planck-Einstein photon theory is that the blackbody radiation problem was an empirical refutation of the classical electromagnetic field

theory of Maxwell. "The convention Planck and Einstein presented, which turned out to be invalid after all as we have shown, did not repair the deficiency of Maxwell's theory." No change was made in Maxwell's theory after the Planck's proposal. So, "they combined these two mutually contradicting theories together to have a theory that makes opportunistic choice." When it comes to most of the classical part of electromagnetic issues, they use the original Maxwell's theory and when it comes to the issue of the light waves, they choose Planck-Einstein addition, which contradicts Maxwell. They have no idea about the logical issues here. Maxwell's theory still proves the prediction on the blackbody radiation which contradicts the experiment. So, the resulting theory obtained by adding the Planck-Einstein equation is still inconsistent. Moreover, the above mentioned $e = hf = c^2hf$ makes the resulting theory inconsistent. This very culture which proclaims that mathematics is just a language created this kind of utterly embarrassing situation leading to the dead end of the entire discipline. "Theoretical physics has become relevant only to popular science of space traveling." That virtually nobody cared about the passing of Hawking, the second Einstein, really reflects the crisis physics community is facing.

Going back to Dirac, he of course knew nothing about this fatal error of Planck-Einstein. He believed in it. But Dirac was rightly unhappy with the *ad hoc* nature of the process of obtaining the equation $e = 0/0 = hf$. He concluded that getting photons from electromagnetic wave equation is the wrong thing to do. Instead, he presented the photons through Fourier expansion of the vector potential. In this way, he managed to obtain a richer theory of photons. Moreover, deducing photons through Fourier expansion of vector potential lacks in ontology. Also, the quantization of the charges and currents in the Maxwell's theory remained to be redone.

Dirac's "solution" to the problem of correct quantization of charges and particles is to rely upon the Schrödinger wave equations. He found it impossible to "quantize" charges and particles as they are already particles. According to the basic principle of wave-particle duality, namely de Broglie relation, "quantum particles" must come from waves. So, he first converted particles such as charges into the Schrödinger wave equations. Instead of going through von Neumann's quantization, Dirac used Fourier expansion of the solutions of the wave equations to create quantized particles. Particle interactions are done through the interference of the wave equations derived from the particles. Through this process Dirac obtained more variety of particles and more interesting operators on particles such as the annihilation operators.

Unfortunately, as we have discussed in the section "Is Schrödinger Wave Equation Realtivistic?", Schrödinger's wave equations are not relativistic, meaning that they are not invariant under the Lorentz transformation in general. This means that the claim of Dirac that his new theory of Quantum Electrodynamics is relativistic is false as his quantization uses Schrödinger's wave equations. To make the matter even more confusing, Schrödinger's wave equation was obtained by applying de Broglie relation to classical Hamiltonian theory of particles and this relation is relativistic upon the assumption that the wave of de Broglie is relativistic (meaning Lorentz invariant). That Schrödinger's wave equation is not relativistic is because Schrödinger misunderstood what de Broglie did. Schrödinger used de Broglie relation to convert classical Hamiltonian energy equation into a wave function. De Broglie did not associate a particle to a wave equation however. Indeed, what he did was the opposite. He associated a particle with relativistic energy and relativistic momentum to waves. His wave-particle duality is a one way association. Moreover de Broglie had to assume that the wave equation in his theory has to be relativistic, meaning that it is invariant under the Lorentz transformation. For such a relativistic wave equation, he associated a particle with energy and momentum.

In this way, the so-called wave-particle duality as per Schrödinger is fundamentally flawed, putting the invalidity of relativity theory aside.

After all, as the relativity theory is inconsistent, there is no point in considering whether Dirac's theory is relativistic or not.

Moreover, Dirac quantized electromagnetic fields, which are not physical reality but a "modality", through Fourier expansion to obtain photons. This makes his photons suffer from the same conceptual obscurity as Planck-Einstein's photons, which are also the product of quantizing (in a different way) electromagnetic waves which are "modal" waves.

Regarding Feynmann's Quantum Electrodynamics, despite some improvements such as leaving Hamiltonians behind and moving into the Lagrangian, this theory did not resolve the problem associated with Schrödinger's wave equations discussed just above. Indeed, it is rather difficult to point out what his contributions are. Maybe it is the path integral which made calculation a little easier. However, this is a negligible issue mathematically.

Gordon-Klein's "quantization" of invalid relativistic energy-momentum equation of Einstein does not offer any solution to this fundamental problem that Schrödinger's wave equation is not relativistic. Replacing relativistic energy variable and relativistic momentum variable with energy operator and momentum operator in the faulty relativistic energy-momentum relation is not what we should call quantization. What we see here is a typical "opportunism" inherent in empiricism.

After all, we have some major questions regarding this enterprise of Quantum Physics leading to Quantum Electrodynamics.

(i) There are way too many concepts of quantization. Namely, Planck-Einstein quantization of electromagnetic waves, de Broglie's quantization of associating "relativistic waves" with a particle with momentum and energy through analogy between the transformation of relativistic waves and transformation of energy-momentum, Schrödinger's quantization of converting classical particle equations into wave equations using de Broglie's relation, Dirac's quantization of electromagnetic fields through Fourier expansion, Dirac's quantization of "particles" expressed as Schrödinger wave equations through Fourier expansion, Gordon-Klein's quantization of Einstein's energy-momentum relation, etc. There is no study of their relations at all.

(ii) To make the matter worse, de Broglie's quantization, which plays key roles in many quantizations as listed above is not properly understood. His quantization works only for relativistic waves that are invariant under the Lorentz transformation. As the momentum-energy of de Broglie particle is related to the transformation of relativistic waves only through analogy, we can not find a way to obtain a wave that is relativistic and represents the original particle. As Schrödinger's wave was created using this obscure de Broglie relation, the validity of it is highly questionable. This makes Dirac's quantization of Schrödinger's wave questionable.

(iii) When it comes to Gordon-Klein equation, which is accepted as an alternative to the failed attempt of making Schrödinger's wave mechanics relativistic, this is an attempt to "quantize" a relativistic relation in an unprecedented way. Does replacing classical variables with corresponding Hermitian operators make the classical theory quantum? If so, why do we have to go through all of this confusing process of quantization which left us even more confused?

(iv) Asking these questions was discouraged and physicists were asked to experimentally verify the predictions of these incoherent theories where the core discussion is based only upon analogy and wrong assumption that Schrödinger's wave equations are relativistic. On the top of it, as Quantum Theory is inherently probabilistic the so-called experimental verification is highly compromised. It was done as the statistical calculation of standard deviation. So, the claimed accuracy of the terribly expensive experiments on particles is verified in the same way we evaluate the accuracy of the prediction of the life span of automobiles. This is the state of the "most advanced" theory of physics.

Regarding (iii) above: The Gordon-Klein equation does not conserve probability, which is one major requirement imposed by the usual interpretation of quantum mechanics. Quantum mechanics interprets the square of the modulus of a wave function's amplitudes as probabilities. For that reason, Schrödinger's equation was made to make sure that the coefficients of wave functions were normalized at every point in time. This unfortunately is not the case for the Klein-Gordon equation. Needless to say, it cannot thus be seen as a valid replacement for a relativistic version of Schrödinger's equation. In order to conserve probability, a time evolution equation needs to satisfy the following condition with regards to a wave function

$$\int \left|\psi(x,t)^2\right| dx = 1$$

Furthermore, as the conservation must hold at any point in time, it has to be independent of time evolution. This is to say that the Gordon-Kein equation must satisfy the following equation as well

$$\frac{\partial}{\partial t} \int \left|\psi(x,t)^2\right| dx = 0.$$

Now consider the Gordon-Klein equation

$$\frac{1}{c^2}\frac{\hbar^2\partial^2}{\partial t^2}\psi(x,t) = (\hbar^2\nabla^2 - m^2c^2)\psi(x,t).$$

Since it involves the second derivative with regards to time, it is clear that the first derivative term in the probability conservation expression will in general not disappear. Hence, the expression will not produce the required value 0 and therefore the Gordon-Klein equation clearly does not describe the probability wave that the Schrödinger equation describes.

After all, the most important issue is that relativity theory as per Einstein is false and there is no point in trying to make classical theories relativistic. Classical theories such as the theory of electromagnetism have their own problems. Relativity theory is a wrong answer to the problem of classical electromagnetic theory. Considering the fact that relativity theory came from the wrong interpretation of the Michelson-Morley experiment, the entire project of Quantum Theory must be terminated.

9. Classical Aether Theory

Classical aether theory proposed by Descartes is yet another example of a continuum medium producing atoms (particles) through type lowering. Here, a vortex which is a substructure of the universal medium aether is supposed to be the atom which will induce the inter-atomic forces. We do not know how far we can push this idea as from the start this idea fails at the pain of contradiction. Here is a brief discussion on the basic idea of Descartes regarding aether theory:

(i) *Proposition: "No empty space can exist therefore space must be filled with matter."* Descartes is saying that there is no such thing as geometric space such as 3D space then. As Newton made it clear, no matter what we place in a geometric space, the space itself is a geometric space. Otherwise we cannot even define a motion which is, as Newton said, a function from time to space. The other way of nailing this absurd dogma is that by saying "space must be filled with matter" he is already assuming that space is a container that can be empty. Yet he is claiming that such thing does not exist.

(ii) *Proposition: "Each part of this matter is inclined to move in straight paths, but because parts are close to each other, their interaction makes every part make circular motion. Each part making this circular motion is called vortex. They are often called "atoms". Descartes also assumes that rough matter resists the circular movement more strongly than fine matter."*

It appears that just this claim requires a massive physics. This requires a fully developed and articulate theory of fluid. It is very clear that the theory of fluid should be something much more involved than a particle based dynamics. In fact, we have a serious problem with the transition from particle dynamics to fluid dynamics. It is becoming clearer and clearer that fluid dynamics is a very different theory from particle dynamics. So, it appears that before we venture into aether theory we must have a solid understanding of what fluid mechanics is about. We certainly have not a clear idea about fluid dynamics and its relation with particle dynamics.

(iii) *Proposition: "Due to centrifugal force, matter tends towards the outer edges of the vortex, which causes a condensation of this matter there. The rough matter cannot follow this movement due to its greater inertia—so due to the pressure of the condensed outer matter those parts will be pushed into the center of the vortex. This inward pressure is gravity."* There is no such thing as centrifugal force. This is why this force is called a "fictitious" force. This is a good example of how the violation of the Principle of Relativity of Galileo occurs when we consider reference frames that are under acceleration. This is simply why we do not allow reference frames under acceleration. The effect of the so-called centrifugal force appears only when we consider an object floating inside a container which is rotating about a centre of the rotation. This body tries to stay where it is when the centripetal force pulls the container down. If a body is fixed to the body of the orbiting container, it will not feel any centripetal force. After all this kind of situation is not theolizable as the classical particle dynamics does not allow us to consider things like orbiting container which has an "inside space". To be precise, every object must be a point object in classical dynamics. It may be too limited but there is no other way to theorize the situation. For the sake of sanity, Newton removed all situations that are not to be dealt with mathematically. Tragically his "successors" did not see what he did. He really knew what he was doing. He was a great "improvement" to all of his successors.

Upon the ideas of Descartes, Huygens presented a more "articulate" vortex theory. The following is a short discussion upon his work:

(i) *Proposition: "He assumed that the free moving aether particles are pushed back at the outer borders of the vortex and causing a greater concentration of fine matter at the outer borders of the vortices. This causes the fine matter press the rough matter into the center of the vortex."* It is not clear how this distribution of the fine matter (aether particles) will occur. This argument requires a full theory of particle-based fluid mechanics. It requires a very advanced theory to explicate this process. It is hard to believe that in the 17th century, they had this kind of theory. More fundamentally, due to the very concept of fluid, particle-based fluid is untenable. Particles and fluid can not be unified. The former is discrete and the latter is continuum. As the space is a continuum, no matter how hard we pack particles, we still have empty spaces in between packed particles. Of course, no theoretical physicist ever understood this nature of continuum. The mathematics they learn as the language for physics will not help them to understand this kind of very deep structure of continuum. Nonetheless, these mathematical facts force aether theorists to accept that particle-based aether does not exist. The only aether we can think of must be continuum fluid. Clearly Einstein had not this mathematical background to understand this issue. Neither did Hawking. He "understood" Gödel's Second Incompleteness about a decade ago.

(ii) *Proposition: "According to Huygens the centrifugal force is equal to the force, which acts in the opposite direction of the centripetal force."* Again, this claim needs a fully developed fluid theory. His definition of centripetal force and centrifugal force are different from standard Newtonian version. Newton's version is simple and clear. There is no such thing

as centrifugal force. It is a misunderstanding of the fact that a free body inside a container will remain where it is despite the motion of the container under acceleration. So, there is no such thing as centrifugal force. It is categorized as a fake force (fictitious force). This "force" came in as Newton's successors misunderstood Newton's theory and included the reference frame.

(iii) *Proposition: "He also assumed that "bodies", whatever they may be, must consist mostly of "empty space" so that the aether can penetrate the bodies."* He assumed that there is no such thing as empty space. Moreover, there is no definition of a body.

(iv) *Proposition : "He further concluded that the aether moves much faster than the falling bodies."* A more fundamental question is what is causing the motion of aether (aether particles) such as fine matters and rough matters? The same question can be asked about the issue of the motion of bodies.

(v) *Proposition: "His theory could not explicate Newton's Law of Gravity, the inverse square law. Huygens tried to deal with this problem by assuming that the speed of the aether is smaller in greater distance."* Again, the same problem as above. We do not know what is the speed of aether until what causes the motion of aether.

Overall judgment on Huygen's aether theory is that it failed to explicate the dynamics of aether itself. It appears that it is something even more complex than what we know as fluid dynamics. This fluid dynamics is a derivative of Newton's dynamics with great compromises. Fluid dynamics is continuum dynamics as fluid is a continuum. So, a lot of compromise had to be made in order to develop fluid dynamics. For example "pressure" is a highly questionable derivative of Newton's force as a vector. In dynamics, force is applicable only to a point matter because force is a pointed arrow. But they had to extend this concept to not a point but to an area or to a volume, going backward of the direction Newton took to make physics possible which is to reduce a continuum body to a point body. But after all, this compromise and Newton Mechanics combined created fluid dynamics. So, it is hard to believe that one can frame a theory of aether without using Newton's mechanics as it was the case with Fluid Dynamics. They had to use Newton's Dynamics in a very twisted way to frame the theory of fluid. The original aether theory was developed during the time when Logicism was suppressed as the "funding philosophy of middle ages cosmology". It is karma that this disrespect of logic is now haunting theoretical physics which is going through a devastating crisis. Contrary to that, logic is now opening up a new world of science that is more articulate and that produces more contribution to humanity than obsolete theoretical physics which had little respect towards logic. Readers may ask why logic in physics. The answer is that logic rules in any human intellectual activity. This is the most fundamental tenant of human intelligence.

We have discussed the difficulty in producing continuum dynamics (fluid dynamics) from particle dynamics of Newton. Of course nobody with the right mindset will try to produce particle dynamics from fluid dynamics in traditional world of physics. Aether theorists seem to be the only exceptions. In this theory they start with a super fluid structure called aether and induce particles called atoms from the aether. This is yet another example of type lowering taking place in theoretical physics as the fluid is a continuum made from points. So, the trouble associated with the type lowering manifests itself in any aether theory.

The above notwithstanding, as we discussed above, Lorentz transformation fails to conserve the most fundamental laws of physics such as the law of gravity and the Coulomb's laws, while Galilean transformation conserves them. This was never noticed until now. Why? As we have shown, the reasoning for this failure of invariance is strikingly simple. It is because the introduction of force fields such as gravitational field and electromagnetic field presented a simpler and convenient "short cut" in the fiction for the nasty nonlinear problems of the gravitational force and electromagnetic force. Maxwell was compelled to drop his aether theory

and accept the field theory for electromagnetism by Heaviside and Hertz as a shortcut to the problem of nonlinearity. What is ironic is that field theories are examples of aether theory.

10. Type Lowering in Mathematics

The problem of type lowering which we discussed in the preceedings in the context of theoretical physics also appeared in mathematics in more acute forms. We will discuss some of them here.

10.1. Scott Model of Lambda Calculus [28]

Church developed a symbolic reductional calculus called λ *-calculus* which described the theory of applying a function of one variable to another such function. By defining natural numbers as a special collection of such symbolic functions, he simulated universal Turing machine showing that his calculus has the same computational power as that of Turing machines. But since its invention, this formal calculus needed a proof that this reductional calculus is consistent. Dana Scott presented an interpretation of this symbolic calculus by considering a set equation

$$D = [D \to D]$$

where the right hand side represents the set of all functions from the set D to itself. It is a well know fact that for any set D, $[D \to D]$ is larger than D. So, Scott introduced a complete lattice structure and restricted the elements of $[D \to D]$ to order continuous functions. In this way he manage to cut down the size of $[D \to D]$ and establish a complete order isomorphism between the left side and right side of the above equation, presenting the "first model of λ-calculus". This success came with a price to pay. Now we identify a natural number to an element of D which is infinitary. Therefore in his calculus we can not decide if two natural numbers are equal. In the model of Scott, if a term is reducible to another term, semantically, there are many terms which are not syntactically the terms which represent natural numbers but we can not find that using the syntactic reduction of the calculus. Logicians call this kind of natural numbers recursive natural numbers.

10.2. Universal Set Theory CFG

Consider the solution of the following set equation

$$S = [S \to T]$$

where T is the truth value set $\{true, false\}$. Unfortunately this equation has no solution as the right hand side again is larger than the left hand side. Russel presented this problem as the famous set as one (left side of the equation) and set as many (right side of the equation) paradox. This tells us that the claim that a set can be fully described by its characteristic function is not correct. This is yet another paradox of set theory. The method Scott developed to solve $D = [D \to D]$ gives us a solution as the collection of order continuous functions. But it is a well known fact that sets as characteristic functions in mathematics are not "order continuous" though they are "order monotonic". So, we have to solve the equation as the collection of order monotonic functions from S to T. Apostoli and Kanda [3] find a solution as a set of monotonic functions from S to T. In this way Apostoli and Kanda obtained the first consistent universal set theory which has the set universe S. But this set theory, called CFG, has a drawback. CFG cannot identify two sets on the basis of the "extensional identity" which says that two sets are equal if and only if they are made of exactly the same member sets. The so-called Axiom of the Extensionality fails. It is replaced by the Axiom of indiscernibility which says that two sets are equal if and only if they belong to exactly the same members of S. The loss of extensional membership relation makes it unusable in the mathematics for working mathematicians. This is yet another price we pay for the type lowering.

10.3. Type Lowering in Recursion Theory [25]
Recursion theory is a branch of mathematical logic developed by G"odel in which we define computable partial functions of natural numbers as functional programs over natural numbers. Using Turing machines, Gödel showed how to calculate a natural number which uniquely represent a functional program as a natural number. This process is called Gödel numbering of partial recursive functions. This process certainly is a type lowering from the type of computable functions to natural numbers. Here each computable function will be represented by infinitely many natural numbers each of which represents a functional program that computes the computable function. This implies that there are infinitely many recursive programs for each computable function. However, at the pain of contradiction, given two natural numbers, we can not computationally decide if the functions by these two numbers are the same or not. So, we loose the identity of computable functions.

11. Type Lifting in Mathematics and Particle Based Physics

Understanding all of these fundamental difficulties the top down approach creates, mathematicians took the bottom up approach as a better methodology for building mathematical theories. A good example is the development of the theory of real numbers which virtually no physicists understand though they use real numbers. It goes as follows:

(i) Natural numbers: closed under the operations $+$ and $\times$.

(ii) Integers: closed under the operations $+, \times$ and $-$.

(iii) Rational numbers are precisely the fractions n/m of integers where $m \neq 0$: closed under $+, -, \times$ and $\div$. They are precisely the repeating infinite decimals.

(iv) Irrational numbers are non repeating infinite decimals.

(v) Real numbers are precisely the collection of all rational numbers and irrational numbers. Real numbers are also closed under $+, -, \times, \div$. Moreover, they are closed under bounded limit.

From this definition of real numbers we can prove that the real numbers are a "bounded complete ordered field." This is because the algebra $(\mathcal{R}, +, -, \times, \div, \leq)$ is an ordered field with the linear ordering $\leq$ and is closed under bounded limit. Here R is the set of all real numbers. The mentioned closure under operations properties can readily be proved except the bounded limit which requires a little bit of work.

This is a simplest way of developing the theory of real numbers so that we can develop it into calculus (mathematical analysis). It is unfortunate that in these days we do not teach theory of real numbers and calculus in this way. Relying upon intuitive naive over-simplistic understanding of "real numbers", they develop calculus replacing the concept of limit by "naive geometric intuition". Then they "explain" the formulas of calculus to be used for physics as a language.

This type lifting (or bottom up) approach is based upon the same philosophy of atomism in physics where the most basic physical entities are atoms and from atoms we build more complex physical entities.

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