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Chapter

OBVIOUS INCONSISTENCIES IN CLASSICAL AND QUANTUM THEORIES

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INTRODUCTION

In this chapter, we present a detailed description of major fundamental problems of physics associated with inconsistencies of major postulates and concepts used in classical, relativistic, quantum and particle physics. We show conceptual difficulties of classical dynamics associated with

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absolute and relative, then with the introduction of such notions as energy, momentum and collision. We disclose difficulties related to the introduction of electrodynamics based on hydrodynamic principles, which are very different from Newton's mechanics of point particles.

Inconsistency of the Special Theory of Relativity (STR) results in the derivation of a negative result on Einstein's Time Dilation argument. In the Theory of General Relativity, Einstein introduced the concept of "inertial forces", which allowed him to operate with accelerating frames. All of his development of General of Relativity is based upon the Equivalence Principle that includes inertial forces. However, no any carriers of these forces as well as gravitational forces were not proposed.

Quantum mechanics uses many postulates of STR (which is problematic itself). Einstein's formula $E = h\nu$ represented a particle called photon that carries energy $h\nu$. To avoid the divergence of the relativistic energy (or mass) of this particle, he assumed that the rest mass of photon was 0. Why? No answer! With this equation, he drove for photons: $p = h/\lambda$ where λ is the wavelength (which nobody can explain, what does it mean?). This relation was called "energy-momentum relation for photons". Here is another contradiction hidden, namely, the assumption 0/0…

Starting with the relativistic theory of electromagnetic field, Dirac induced a new quantization of electromagnetic waves, new concept of photons – the Fourier expanded vector potential yielded photons of a new kind. Unlike Planck-Einstein's photons, these (Heisenberg's) photons came directly from the formalism of Maxwell's electromagnetic field theory. Heisenberg's photons are equipped with the creation and annihilation operator.

It is unfortunate that virtually no study was made to investigate the relation between these two types of photons used in quantum electrodynamics. According to quantum mechanics, due to the Uncertainty Principle, when we localize a particle, it turns into a wave and it loses the particle characteristic. So, there must be no trajectories in the Wilson Chamber. However, trajectories do appear. Does this mean that the Uncertainty Principle is not true? Moreover, the trajectories are created by continuous collisions of an accelerated charge with water molecules. The speed and momentum of particles inside the Wilson chamber are calculated using the theoretical formulas of quantum electrodynamics. The calculations complete ignore collisions and the interaction with water molecules.

There are also inconsistencies in nuclear physics that still cannot suggest the reliable source of the so-called nuclear forces – they could be mesons, though on the other hand they should be the residual interaction appeared from the strong interaction.

Many problems exist in particle physics too in which in which the problem of integer or fractional charges of quarks still open. Besides, there are many questions to the discovered particle of 2012 – was that the Higgs Boson or an intermediate particle composed of three quarks, or whether it could be a krypton ion in general?

CLASSICAL DYNAMICS

2.1. Absolute and Relative

Assume there are two masses M and m are in the space. They are attracting each other with the gravitational force $F = GmM/r^2$. By the second law M is approaching m with acceleration Gm/r^2 and m is approaching M with acceleration GM/r^2. So, unless $m = M$, then M and m will observe each other approaching with different speed. This is a contradiction.

Newton's answer to the contradiction is as follows: The observer is standing on the shoulder of God outside of the universe (absolute frame) observing. In this settings laws of dynamics hold. So, the observer will observe that M and m are accelerating with absolute acceleration GM/r^2 and Gm/r^2 respectively. So, they are accelerating towards each other with "relative" acceleration $GM/r^2 + Gm/r^2$. In short, Newton resolved this problem by accepting only absolute frame observed from outside. He introduced the concept of relative motion (speed, acceleration) as the difference of absolute motion (speed, acceleration).

This means that his dynamics works only for absolute space, rejecting Galilean relativity in which reference frames move relative to each other. This is consistent with the fact that in the system of *M* and *m*, considering *m*'s perspective for the motion of *M* violates the Action-Reaction Law of Newton. It is because *m* is not moving in this argument. So, in short, we can conclude that Galilean relativity theory is inconsistent with Newton dynamics and one cannot apply Newton's law of dynamics to relativistic reference frames of Galileo.

2.2. Energy, Momentum and Collision

The standard definition that the kinematic energy of $m\upsilon$ is the work needed to accelerate the object studied from $m0$ to $m\upsilon$ and it is $m\upsilon^2/2$ is false. Depending on the way we accelerate, the work in consideration varies and setting it to $m\upsilon^2/2$ breaks the conservation of energy law. It was not Newton but Leibniz who introduced the energy concept.

Unlike the hypothetical potential energy field around us on the surface of earth, the potential energy created by a point mass increases as the distance between a test mass and the point mass decreases. This is due to the second law of Newton. The second law also increases the kinetic energy under this situation, clearly the conservation of energy is violated.

Momentum conservation seems to be correct under the situation where *M* and *m* are pulling each other by gravitational force as momentum is a vector.

In case of collision, as the collision of masses is singularity due to the law of Gravitation, and clearly the Conservation of energy is not valid in this setting as discussed above, they assume that there is no gravitational force among colliding point masses. All masses are in inertial motion. They say that this is true as in most cases, masses we deal with are so small to generate material attractive force among them. However, how about the formation of a hydrogen star? It seems the star is formed because of the gravitational force among hydrogen atoms, which are totally negligible.

3. ELECTRODYNAMICS V.S. NEWTONIAN DYNAMICS

It is a relatively unknown fact that the concept of force field is not physical reality. Indeed, spatial distribution of force per unit charge (mass) can hardly be a reality. It is a modal concept. In classical dynamics, force field was not accepted for this convincing reason. It appears that the fluid dynamics which was developed mainly in Cambridge in the 18th and 19th century promoted this concept and was adopted in electromagnetic theory despite the reluctance by Maxwell. Though fluid dynamics is an important development in theoretical physics and the nature of field involved in this theory is more complex, we will not cover this issue here. Moreover, the field concept reduces a charge (or mass) to a spatial entity that clearly violates the Action-Reaction Law governing all most fundamental theories of dynamics. As we know, nothing can affect the entity that created this force field. This is sufficient reason to reject this approach. Newton certainly rejected it.

Since Hertz and Heaviside convinced Maxwell to use electric force field and magnetic force field, electromagnetism theory started to suffer from mountain of problems and physicists did not want to recognize the problems. One of the major issue is that nobody knows what is reality and what is modality anymore (Leibniz's modal metaphysics is the metaphysics of necessity, contingency, and possibility). The biggest problem appeared when Maxwell discovered the "existence" of electromagnetic waves as wave equations. As the electromagnetic field is modality (i.e., a future event or circumstance which is possible but cannot be predicted with certainty), not reality, there in fact should be no such reality as electromagnetic waves (EM waves). EM waves do not occupy the whole space. It in fact is nothing but the point to point transmission of the change of EM force from the source to the receiver.

EM theory is good example of how empiricism works in pure science. All laws of EM theory were obtained by the experiments done in our lab frame. This is a major difference from Newton's dynamics and EM theory. So, in the end EM theory ended up with the same restriction that relativity concept will not work well. It is essentially an absolute theory that cannot be relativised. Faraday induction is a good example. When a charge moves in a frame, it induces a magnetic field in the frame. But there is no induced magnetic field in the frame of the moving charge. The same problem appears in the EM wave emission. When a charge is accelerated in our frame, it induces photons (EM wave) in our frame. But it does not induce the photons (EM wave) in its own frame.

Classical dynamics asserts $f = ma$ where f is force, m is mass and a is acceleration. Newton left f to be unspecified. As an example, he gave gravitational force. According to Lorentz, the force applied on a charge also depends upon the speed of the charge. This is a completely irreconcilable conflict. This clearly shows that it is impossible to unify classical dynamics and classical EM theory. This is to say that electrodynamics is fundamentally flawed. Problem started at this very early stage of theoretical physics and none of these issues were even noticed and so never resolved.

4. Relativity Theory

4.1. Problem with Inertial Reference Frames: Geometric Contradiction

We have already discussed the problem of contradiction to the Action Reaction Law allowing one reference frame to accelerate in another frame. Physicists' response to this problem was to limit the reference frames only to inertial reference frames so that no reference frame is accelerating. It is unfortunate that this still does not resolve the invalidity of moving reference frames. There is a more fundamental reason why moving reference frames does not work all right. This attempt to move reference frames violates the topology of geometric spaces. For instance, by moving point 0 to point 5 and vice versa, we lose the number line as its topology is destroyed. So, we cannot move even a single point in a geometric space. How is it possible to move entire geometric space inside some other geometric space? In Euclidean geometry of ancient Greece, certainly there was no system of coordinates. It is a “descriptive geometry”. So, one may hope that as long as we stick to such geometry, we should be all right. One should be aware of the fact that descriptive geometry also does not involve moving any geometric point. All we deal with is not moving a point but establishing abstract correspondence of two points. In modern term as French topologist Rene Thom (see, e.g., Ref. [1]) said, as a single point in geometric space is accessible only by taking limit, we have no finitely access to any point in the geometric space. Of course, we cannot move such point. As a consequence of violating this fundamental principle of geometry and allowing a reference frame moves inside other reference frames, without involving any acceleration (force), we will end up with the following contradiction, which we call “geometric contradiction”: Assume an electric train runs on a track and when the power pole of the train touches the power line at point A spark occurs. An observer B in the train will observe that as the point A is a point of the train, the light comes straight down to him from this point of the train. As this point A is also a moving point of the train, which is a stationary point of the power line, he will also observe that the light comes diagonally from the moving point in his frame.

This contradiction decisively establishes that despite the attempt to give up accelerating frames and to consider only inertial reference frames, i.e., making relativity theory pure kinematics, we still have a fundamental contradiction that is more basic than the violation of the Action-Reaction law of Newton. It is the violation of the basic law of geometry.

4.2. Inconsistency of the Special Theory of Relativity

As a consequence of the contradiction above, we have a negative result on Einstein’s Time Dilation argument. In the thought experiment above, Einstein put another observer on the embankment. This observer will see that the light traveled from the stationary point A on the power line to the observer in the train that is moving. So, the light travels diagonally. Einstein did not see that the observer in the train will also observe that the light travels diagonally from the stationary point A of the power line which is a moving point in the frame of the train. So, he concluded that, under the assumption of the Constancy of the Speed of Light (CSL), which claims that the speed of light is the same in all inertial reference frames, the time for the observer in the train and that for the observer on the embankment are not the same. Time on the train dilates when observed from the embankment.

It is unfortunate that his “revolutionary argument” is marred by the contradiction that occurs in the frame of the observer and it is invalid. This makes the Special Theory of Relativity (STR) inconsistent and so invalid. It is a well-known basic logical fact that by adding new assumptions such as the CSL, one cannot remove the contradiction. In short as the Galilean relativity theory is already inconsistent, STR which is CSL plus Galilean relativity theory also is inconsistent. Without knowing, Einstein inherited this fatal problem from Galileo’s relativity theory. However, it was Einstein’s responsibility to check the validity of Galileo’s relativity theory. Wrongly Einstein thought that the only problem with Galileo’s relativity theory was that it lacks in the assumption of the constancy of speed of light.

Another controversy surrounding STR is the CSL assumption itself. It was supposed to have come from the Michelson-Morley’s failure to detect the effect of the speed υ of the emitter of light in the measurement of the speed of light measured from the stationary observer. As synchronization of the clocks at distance was considered to be impossible, Michelson and Morley used reflected light to measure this υ. This is because with this method, we use only one clock and a mirror at a fixed distance. (They intended to measure the speed of light emitted by us moving with absolute speed υ in the absolute frame.) This method will fail to detect this υ. It is because even if light moves with speed $c + \upsilon$ in the absolute space, the mirror also moves with speed υ in the absolute space and so the effect of υ cancels. Also on the way back, though the speed of light could be $c - \upsilon$ as the mirror is moving with speed υ, the receiver of the reflected light also moves with the speed υ in the absolute frame. So, over all, the speed υ is cancelled and we will observe that the light moved with speed c. This means that in this method, we cannot detect the effect of υ in the speed of light. So, it is wrong to assume the CSL. Student Annand (of Akira Kanda) showed that we can measure the speed of light without using reflected light. His ingenious method still shows that we cannot detect the effect of υ, the speed of the emitter of light in the resulting speed of light. Again, the CSL failed.

With this kind of serious inconsistency at the most basic level, naturally this theory STR produced renowned contradictions such as Dingle's clock contradiction and the car hole contradiction. The latter goes as follows: Assume a car is running on a road and there is a hole on the road. Assume the length of the car and that of the hole are the same at rest. When the car runs towards the hole, the hole's length shrinks and the car will not fall into the hole. From the perspective of the hole the car shrinks and so the car will fall into the hole. There are many desperate attempt to resolve these contradictions and all of them simply showed that logical deficiency.

4.3. Lorentz Transformation and Minkowski's 4D Spacetime Formalism

The so-called Lorentz transformation was developed by Lorentz for the purpose of resolving the problem that the Galilean Transformation of EM wave equation is not an EM equation making the EM wave equation variant under the Galilean Transformation. As Lorentz showed, Maxwell's EM wave equation is transformed into an EM wave equation. However, it is clear that a wave function is transformed into a wave function under the Lorentz Transformation. Einstein combined the time dilation and length contraction and introduced a linear transformation from a 4D spacetime to the other. Then Einstein derived the same Lorentz transformation from one inertial frame to the other using "relativistic" time dilation and length contraction.

As the history of the Lorentz transformation discussed above suggests, it is not quite clear if the Lorentz Transformation derives time dilation and length contraction. At some disputes mathematical physicists argue that in fact Lorentz Transformation and Time Dilation, Length Contraction are not the same thing.

Einstein's Lorentz Transformation is a 3D space F to another F′ and additional time transformation reflect time dilation and length contraction. Here it is assumed that F and F′ move relative to each other with classically measured speed υ. The 3D transformation part is marred by contradiction stated. Einstein did not consider Lorentz transformation as a linear transformation from 4D spacetime to 4D spacetime.

It was Minkowski who considered Lorentz transformation as a linear transformation from 4D spacetime to "itself". As there is no reference frames moving relative to each other in this way he managed to get around the difficulty of contradictions coming from moving 3D spaces. With this development, the mainstream theoretical physics community declared that all questions regarding STR are resolved and any more criticisms are purely the matter of misunderstanding.

In case of Einstein's theory of Lorentz transformations, two reference frames F and F′ move relative to each other and so it failed to remove the contradiction coming from moving (inertial) reference frames. In case of Minkowski, υ in the Lorentz transformation represents nothing physical anymore. Indeed, in 4D spacetime nothing moves.

In both cases of Einstein and Minkowski, $\upsilon = d/t$ and d and t are measured value. So, it is expected that $d'/t' = \upsilon$ as d' and t' are also measured value. However, this is not the case. So, we have created a new contradiction.

4.4. STR Dynamics

Einstein observed the following contradiction caused by accelerating reference frames: Assume a train is accelerating, a tree on the embankment is accelerating in opposite direction from the perspective of the train. This does not mean that the tree is under force to accelerate. We presented a more fundamental argument to establish this contradiction by considering two pint masses M and m and consider the gravitational force between them to conclude that the Action Reaction law is violated. After all, due to this problem, Einstein abandoned the usage of accelerated reference frames and built STR which considers only inertial reference frames. We have shown that despite this restriction, still assumption of moving reference frames violates the basic principle of geometry that no geometric point can move leading to contradictions.

Under the firm belief that his STR is correct, Einstein tried to regain the dynamics in Relativity Theory. Let us call this attempted theory SRT dynamics. Through thought experiment which involves two inertial frames, Einstein obtains the concept of relativistic mass $m = m_0\sqrt{1 - \upsilon^2/c^2}$ and the appropriate relativistic momentum. From this he obtained the relativistic second law:

$$f = (m\upsilon)' = m'\upsilon + m\upsilon'. \tag{4.1}$$

From expression (1) he obtained $E = mc^2$. What he missed is that as υ is constant, we have $f = 0$ and so, $E = 0$. Relativists argue that they have alternative proofs for $E = mc^2$. But if so this we conclude that SRT dynamics is logically inconsistent. It proves both $E = 0$ and $E = mc^2$.

What is astounding about this development is that despite that the possibility of considering reference frames under acceleration is completely none, and they accepted it when they built STR, they ignored this restriction and brought the accelerating reference frames back to develop this ill-fated theory of STR dynamics which mislead the entire theoretical physics for years.

The phenomenological formalism of STR dynamics does not prove the rightness of the formula $E = mc^2$ though it is used as basic in the microscopic formalism of high-energy physics in which the formula is considered as absolutely correct.

In expression (1) we can see one more term, $m'\upsilon$, which is put equal to zero because the mass m of the object studies is believed to be constant. Nevertheless, it seems de Broglie [2] was the first who raised the question about a variation of the mass of a moving body. His idea was further developed by one of the authors [3]; namely, it was shown that the motion of a particle occurs with a periodical variation of the particle's mass. Thus, it was theoretically demonstrated that the mass is not constant (and the hypothesis was really experimentally verified [3]). This is an additional argument in favor of the fact that SRT Dynamics is logically inconsistent.

5. A Set of Speeds as an Interval Allows the Prove of the Transformation Rules

The above analysis of the special theory of relativity has shown that the assumption of moving reference frames violates the basic principle of geometry according to which no geometric point can move leading to contradictions. In this section, we will consider some possible assumptions allowing the motion of geometric frames, which may permit the vitality of STR.

Let us look at the relativist speed addition law (RSA) in one-dimensional scalar notation. If an inertial frame S' moves relatively to an inertial frame S with speed υ, and a material point moves relatively to S' with speed u, then the material point moves relatively to S with speed

$$w = (\upsilon + u)/(1 + \upsilon u/c^2). \tag{5.1}$$

If one accepts the hypothesis H, that Galilean speed additional law ($u + \upsilon$) is deduced from principle of relativity, while the relativist speed addition law is deduced from the principle of relativity + constant speed light, then the principle of relativity + CSL is an inconsistent theory.

A simultaneous validity of GSA and RSA leads to numeric contradictions of type 1 = 0, as it does in all cases in which both $u > 0$ and $\upsilon > 0$ are composed ("added").

But it is also accepted that the Special Theory of Relativity is consistent, as it has "models", like Einstein's model consisting of moving frames in $\mathbb{R}^3$ or like Minkowski's Space-Time endowed with the Lorentz (Poincaré) transformations. At this point one must add that Einstein and Minkowski had different theories of relativity. Einstein's theory is intentional and Minkowski's theory is extensional. The former refers to infinitely many reference frames while the later refers to only one 4-dimensional space-time. The later has its own interpretation of speeds u and υ, with a different physical meaning (rotation of the space-time).

We deduce the Lorentz and the Galilean transformation rules in a many-sorted first-order structure where moving points and moving frames are abstract sorts. If we suppose that the set of speeds allowed for the relative movement of frames is an interval, then both transformation rules can be proven if one states orientation, compatibility with the relative speed, symmetry, and an axiom about the existence or non-existence of invariant speeds. A very popular axiom called reciprocity will be used in the proofs, but can be deduced from the other axioms. Every ordered field can be expanded to a model of the Galilean transformation and every Euclidian ordered field can be expanded to a model of the Lorentz transformation.

In order to escape the contradictions deriving from both moving frames and absolute space living in the same space $\mathbb{R}^3$ we prefer to choose a many-sorted approach, with disjoint frames of reference. As the model consists of different disjoint frames of reference (copies of the space-time) and because interactions across them are prohibited, the model is not a physical model. On the other hand, we doubt that a physical model can be really constructed for this theory.

We prove that RSA follows from axioms called Orientation, Compatibility with the relative speed and the existence of invariant speeds, while GSA follows from Orientation, Compatibility with the relative speed and the fact that no invariant speed does exist. If we add to those axioms only the symmetry of the time as function of the space (or only the symmetry of the space as function of the time), we get the Lorentz transformations or, respectively, the Galilean transformations. The principle of reciprocity is intensively used in the proofs, but can be eliminated from the axioms.

A model of the Special Theory of Relativity must contain definitions of the notion space, time and motion such that the following requirement is fulfilled: *Any moving point with speed c has the same speed relatively to all inertial frames*. As we focus on the speed addition laws in their one-dimensional version, only one-dimensional models will be considered. The space is identified with the real line R. Intuitively, the time axis is also a copy of R. All moving points and all moving frames have a linear constant speed movement. The only one property of moving points which occurs in this reduced model is nothing than their speed.

In this many-sorted approach inertial frames are just different copies of $K \times K$ and nothing is granted. Even the most natural physical intuition must be stated as an axiom. From all coefficients of the general transformations T_{SS_0}, the coefficient is the most difficult to understand, because it expresses the connection between t_0 and x. We have no intuition and no ontology for this coefficient. The difficulty of every axiomatic approach is that one has to add sufficient information in order to find out, and this is not possible directly. This is possible only by side effects.

6. A Many-Sorted Approach to the Special Theory of Relativity

The Lorentz and Galilean transformation rules could be deduced in a many-sorted first-order structure where moving points and moving frames are abstract sorts. The spaces associated with moving inertial frames are disjoint and communicate only over abstract functions. In such a construction, one can distinguish a function identifying representative of moving points according to different inertial frames, and also the Lorentz respectively the Galilean transformations.

This or that aspects of the problem were partly analyzed in literature (see, e.g., Refs. [4-21]). Below we present an axiomatic many-sorted construct to the STR at a level of mathematical abstraction.

6.1. Basic Axioms and Speed Addition Laws

A model of the STR must contain definitions of the notion space, time and motion such that the following requirements are fulfilled:

1. Any moving point with speed c has the same speed relatively to all inertial frames.
2. The inertial frames are moving on linear trajectories with constant speeds $\vec{v}$ with $|\vec{v}| \in (0, c)$ inside some environmental space, and their associated affine (vector) spaces are all overlapping inside this environmental space.

The present approach, by a many-sorted structure, fulfills only the first requirement.

As we focus on the speed addition laws in their one-dimensional version, only one-dimensional models will be considered. The space is identified with the real line $\mathbb{R}$. Intuitively, the time axis is also a copy of $\mathbb{R}$. All moving points and all moving frames have a linear constant speed movement. The only one property of moving points, which occurs in this reduced model, is nothing than their speed.

In a broader generality, we state that:

Definition 1.1. *A model of a relativist theory is a many-sorted structure*

$(K, \mathrm{MP}, \mathrm{IF}, R, T)$

as follows:

1. $(K, +, -, \cdot, <, 0, 1, c)$ is an ordered field satisfying the square-root property:

$\forall x\, x \geq 0 \rightarrow \exists y\, x = y^2$.

The constant c will be interpreted such that $c > 0$.

2. The elements $P \in \mathrm{MP} \neq \emptyset$ *are called moving points.* $\mathrm{IF} \neq \emptyset$ *is a subset of MP:*

$\forall S \in \mathrm{IF}\; S \in \mathrm{MP}$.

$S \in \mathrm{IF}$ *means that the moving point S has an associated inertial frame. We will call such moving points inertial frames or origins of inertial frames*.

3. The function T is an application T: $\mathrm{IF} \times \mathrm{IF} \rightarrow K^6$. *For all* $S, S' \in \mathrm{IF}$ *we denote the value* $T(S, S')$ *with* $T_{SS'} = (\alpha, \beta, \sigma, \delta, \varepsilon, \mu)$. $T_{SS'}$ *is understood as an affine application* $T_{SS'} : K^2 \rightarrow K^2$ *defined as:*

$T_{SS'}(x, t) = (\alpha x + \beta t + \sigma, \delta x + \varepsilon t + \mu) \coloneqq (\varphi_{SS'}(x,t), \theta_{SS'}(x,t))$.

The applications $T_{SS'}$ *are called transformations. They fulfill the following properties:*

(*a*) $\forall S \in \mathrm{IF}\; T_{SS} = 1_{K^2}$

(*b*) $\forall S, S' \in \mathrm{IF}\; (T_{SS'} = 1_{K^2} \rightarrow S = S')$

(*c*) $\forall S, S', S'' \in \mathrm{IF}\; T_{SS''} = T_{S'S''} \circ T_{SS'}$.

4. The function R is an application R : $\mathrm{MP} \times \mathrm{IF} \rightarrow K^2$ *called representation of a moving point in some inertial frame. It fulfills the following conditions:*

(*a*) $\forall S \in \mathrm{IF}\; R(S, S) = (0, 0)$

(*b*) $\forall P_1, P_2 \in \mathrm{MP}\; (\exists S \in \mathrm{IF}\; R(P_1, S) = R(P_2, S)) \rightarrow P_1 = P_2$

(*c*) $\forall P \in \mathrm{MP}\; \forall S, S' \in \mathrm{IF}\; \forall v, x_0, v', x'_0\; R(P, S) = (v, x_0) \wedge R(P, S') = (v', x'_0) \rightarrow \forall t \varphi_{SS'}(vt + x_0, t) = v' \vartheta_{SS'}(vt + x_0, t) + x'_0$.

5. There are many moving points and many inertial frames. More exactly, consider the following statements:

M: = $\forall S \in$ IF $\forall v, x_0$ $\exists P \in$ MP $R(P, S) = (v, x_0)$

M_c: = $\forall S \in$ IF $\forall v, x_0$ ($\exists P \in$ MP $R(P, S) = (v, x_0)$ $\leftrightarrow |v| \le c$)

F: = $\forall P \in$ MP $P \in$ IF

F_c: = $\forall P \in$ MP ($P \in$ IF $\leftrightarrow$ $\exists S \in$ IF $\exists$ v, x_0 $R(P, S)$=(v, x_0) $\wedge |v| < c$)

Then the axiom to fulfill is: (M $\wedge$ F) $\vee$ ($M_c \wedge F_c$).

6. We suppose that the projections π_1, π_2 : $K^2 \to K$ and: $K^6 \to K$ *are given in the language. Also we permit to build a pair* $(x, y) \in K^2$ *from two elements* $x, y \in K$ *and a 6-tuple* $(x_1, ..., x_6) \in K^6$ *from six elements* $x_1, ..., x_6 \in K$.

Remark 1.2. Ordered fields with this square root property are called also Euclidian fields.

Definition 1.11. *Let* V_{MP} *be the set of speeds of moving points relatively to inertial frames and let* V_{IF} *be the set of relative speeds for moving inertial frames. Only two situations are allowed by definition:* $V_{\mathrm{MP}} = V_{\mathrm{IF}} = K$ *or* $V_{\mathrm{MP}} = [-c, c]$ $\wedge$ $V_{\mathrm{IF}} = (-c, c)$.

Remark 1.12. We permit to build up an event (x, t) from a value of x and a value of t, to build up a moving point (v, x_0) relatively to some frame S from a value v and a value x_0, or to build up a transformation instance $T_{SS'}$ from its coefficients α, …, μ. Consequently we are free to use in our formulas coordinates x and t, speeds v, shifts x_0 or coefficients α, …, μ. We will not explicitly use the projections and the tuple-building in order to not overcharge the notation. We mentioned these projections π_i, π'_j and the tuple-building functions here in order to emphasize that the structure and its theory are many-sorted first-order.

Definition 1.13. *We call the set of axioms included in the Definition 1.1 axioms B and we refer to them as the basic axioms*.

In this many-sorted approach inertial frames are just different copies of $K \times K$ and nothing is granted. Even the most natural physical intuition must be stated as an axiom.

From all coefficients of the general transformations $T_{SS'}$, the coefficient δ is the most difficult to understand, because it expresses the connection between t' and x. We have no intuition and no ontology for this coefficient. The difficulty of every axiomatic approach is that one has to add sufficient information in order to find out δ, and this is not possible directly. This is possible only by side effects.

6.2. Further Specific Axioms

The conditions B put so far assures already the most basic request on coordinate transformations between inertial frame coordinates. This is the property of Good Witness (GW):

Lemma 2.1. *GW If two events are seen as different according to an inertial frame S, they are seen as different according to every other inertial frame S'.*

We state the following axiom of Orientation (OR), which we consider reasonable: OR For any t_0, the function $\varphi(x, t_0)$ is strictly increasing in x. For any x_0, the function $\theta(x_0, t)$ is strictly increasing in t. Formally, this means:

$$\forall S, S' \in \mathrm{IF} \ \forall x_1, x_2, t_1, t_2$$
$$(x_1 < x_2 \rightarrow \varphi_{SS'}(x_1, t_1) < \varphi_{SS'}(x_2, t_1)) \wedge (t_1 < t_2 \rightarrow \theta_{SS'}(x_1, t_1) < \theta_{SS'}(x_1, t_2)).$$

Now we introduce an axiom that expresses the Compatibility of the transformation with the Relative Speed between inertial frames (CRS):

CRS If the inertial frame S' moves with speed v relatively to the inertial frame *S*, all moving points which have speed v relatively to *S* are resting in S'.

Formally this means:

$$\forall S, S' \in \text{IF } \forall P \in \text{MP Speed } (P, S) = \text{Speed } (S', S) \rightarrow \text{Speed}(P, S') = 0.$$

The following procedure, called synchronization, is widely used in physics. Suppose that two inertial frames *S* and S' are so that S' moves with some speed $v \neq 0$ relatively to *S*, and at the moment $t = 0$ relatively to *S* their origins coincide: $\exists v\ R(S', S) = (v, 0)$. If the corresponding time in S' has the value $\theta_{SS'}(0, 0) = t'_0$ one can replace t' with $t' - t'_0$, such that at $t = 0$ one has $t' = \theta_{SS'}(0, 0) = 0$.

Lemma 2.2. *The condition that S and S' are synchronized* ($t = 0$ *in the origin of S implies* $t' = 0$ *in the origin of* S'*) and that* $\exists v\ R(S', S) = (v, 0)$ *are equivalent with* $T_{SS'}(0, 0) = (0, 0)$.

The following axiom is considered in physics books to be the more important fact on which both the Galilean and Lorentz transformation are based. It is called Principle of Reciprocity (R):

R *If the inertial frame S' moves with speed v relatively to the inertial frame S, then the frame S moves with speed $-v$ relatively to S'.*

This means:

$$\forall S, S' \in \text{IF Speed } (S', S) + \text{Speed } (S', S) = 0.$$

Now we introduce the existence of an Invariant Speed (IS) relatively to the different inertial frames:

IS There is a speed $u_i \neq 0$ such that for all inertial frames *S* and S', u_i is not the exceptional speed of *S* for S' and if a point *P* moves according to *S* with speed u_j, then *P* moves according to S' with speed u_j.

Formally:

$\exists u_i \neq 0\ \forall S, S' \in$ IF $\forall P \in$ MP ($\delta_{SS'} = 0 \lor \delta_{SS'} \neq \varepsilon_{SS'}$)
$\land$ Speed(P, S) = $u_i \rightarrow$ Speed(P, S') = u_j.

Let IS± be the axiom stating explicitly the same things for both u_i and $-u_j$. In some situations IS± follows from IS, but in other situations it does not.

Remark 2.3. *The axiom IS is much stronger than the classical Constancy of the Light Speed. It is a statement about a speed (this means, about a number!) and not about light or about electromagnetic waves. However, the classics of Relativity Theory stated CSL but in fact meant IS.*

Lemma 2.4. *Under* B *and* CRS, IS *implies that* $\mathrm{M}_c \land \mathrm{F}_c$ *is true and that the invariant speed* u_i *is one of the speeds* c *and* $-c$. *Under* B *and* CRS, IS± *implies that* $\mathrm{M}_c \land \mathrm{F}_c$ *is true and both speeds* c *and* $-c$ *are invariant speeds. In this case, they are the unique invariant speeds. Under* B, OR *and* CRS, IS *implies* IS± *and that both speeds* c *and* $-c$ *are the unique invariant speeds.*

In order to derive the Galilean Speed Addition, we need a stronger axiom, No Invariant Speed (NIS):

NIS: *For all inertial frames S and* S', *if* S' *is moving with speed* $v \neq 0$ *relatively to S, and a moving point P moves with speed u relatively to S and with speed* u' *relatively to* S', *then* $u \neq u'$.

$\forall S, S' \in$ IF $\forall P \in$ MP Speed(S', S) $\neq 0 \rightarrow$ Speed(P, S) $\neq$ Speed(P, S').

Another essential axiom is the Symmetry (SY):

SY *Let S*, S' *and* S'' *be three inertial systems such that* $\Omega(S, S')$, $\Omega(S, S'')$, *such that* S' *moves with speed v relatively to S and* S'' moves with speed $-v$ relatively to S. Then $\varphi_{SS'}(x, t) = \varphi_{SS''}(x, -t)$ *and* $\theta_{SS'}(x, t) = \theta_{SS''}(-x, t)$ *for all x and t*.

Formally:

$\forall S, S', S'' \in \mathrm{IF}$
$\Omega(S, S') \wedge \Omega(S, S'') \wedge (\mathrm{Speed}(S', S) = v \wedge \mathrm{Speed}(S'', S) = -v)$
$\rightarrow \forall x, t\ \varphi_{SS'}(x, t) = \varphi_{SS''}(x, -t) \wedge \theta_{SS'}(x, t) = \theta_{SS''}(-x, t)$.

Theorem 2.5. *The Lorentz transformation is the unique origin-preserving transformation compatible with the axioms* B, OR, CRS, IS, SY.

This means that the transformation $T_{SS'}$ is given by:

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

where $\gamma = \gamma(v) = 1/\sqrt{1 - v^2/c^2}$, which is exactly the Lorentz transformation.

Theorem 2.6. *The Galilean transformation is the only one origin-preserving transformation compatible with* B, OR, CRS, NIS, SY.

Recall the Galilean transformation:

$$x' = x - vt,$$
$$t' = t.$$

We observe that the Reciprocity Axiom R, which is intensively used during the proofs, can be finally eliminated. Indeed, both axioms IS and NIS imply R in the given contexts.

6.3. The Lorentz Transformations and the Moving Bodies

The construction done so far lead to an abstract model of the Special Theory of Relativity. We introduced an abstract function which translates some abstract objects called moving points from some inertial frame to another. The point here is that those spaces are disjoint. They do not overlap in some environmental space, as we see in the nature. Also, the image of overlapping relatively moving spaces which fill the space is paradox. Unhappily all proofs of the fundamental properties of STR work with this image, of the space which is rigidly attached to the origin of some inertial frame and which moves with the frame.

About length contraction, there is a deadly viral paradox discovered by a member of the NPA (Natural Philosophy Alliance) who informed Akira Kanda about it. Assume that there is a hole on a road, whose length is the same as a car driving on the road. From the perspective of the driver, the hole shrinks and so the car will not fall into the hole. But from an outside observer on the road, the car shrinks and so the car falls into the hole. The origin of this paradox is exactly the overlapping of relatively moving inertial frames, as also the application to moving bodies. Paradoxes of this kind can be got using asymmetric interactions between bodies associated with relatively moving inertial frames. Massless points in a world without acceleration and without forces do not afford any asymmetric interactions.

A possible origin of those paradox is that one imagines only material devices for measurements, while the idea of measurement is itself an idealization. Once we imagined a material rod, we need to associate some movement to this rod. We believe that the rod must be related with the street or with the car and must co-move with one of them. In fact, the rod does not need any duration. We can imagine some instantaneous rod which exists only a very short time $\Delta t \equiv 0$. Such a rod, which is not relatively moving to anything, contradicts the idea of a really existing length-contraction.

Consider a moving body in the inertial frame S. Classically, a body can be modeled just as a moving interval $[A(t), B(t)]$ where $A(t) = vt + x_0$ and $B(t) = vt + x_0 + L$ with $L > 0$. The body consists of all points of this interval: $M(t) = vt + x_0 + m$, where $0 \leq m \leq L$.

In our framework, the body is represented by a set of moving points. The interval ends are $[A, B] \in \mathrm{MP}$ with $R(A, S) = (v, x_0)$, $R(B, S) = (v, x_0 +$

L) and $L > 0$, intermediary points are $M \in$ MP with $R(M, S) = (v, x_0 + m)$ with $0 \leq m \leq L$. Let S' be an inertial frame moving with speed v relatively to S. By the axiom CRS, all moving points M of which our body consists are resting in S'. There they build the interval $[A', B']$ with $A' = y_0$ and $B' = y_0 + L$.

By applying $T_{S'S}$ (the Lorentz transformation) for the body resting in S' at a given moment of time t', we get the following Remark:

Remark 3.1. *At most one slice $x = k$ of a moving body (body resting in a moving frame S') is contemporary with an observer resting in the frame S. Moreover, relatively to the frame S, every two slices $x = k$ and $x = k'$ are contemporary one relatively to the other if and only if $k = k'$.*

This happens because t does explicitly depend of x': $t = \gamma(\frac{v}{c^2}x' + t')$. To see how strong this dependence can be, observe that:

$$\lim_{v\to c} \frac{\gamma v}{c^2} = \lim_{v\to c} \frac{v}{c^2\sqrt{1 - v^2/c^2}} = +\infty.$$

The Remark allows some interpretations and conclusions:

- When we see a car passing by, it is really not clear what we are looking at. The surest interpretation would be that the different slices composing the driving car (excepting just one of them) are slices from the recent past and from the next future of the car, and that their own times depend on how far those slices are from the slice of contemporaneity. This can be very annoying if the front of the car consists of slices which are so old, that the car hasn't been constructed yet, and the rear of the car consists of slices from a far future, in which the car already will have exploded;

- The time dilation can be accepted, but only for punctiform clocks. Indeed,

$$t_2' - t_1' = \gamma\left(-\frac{v}{c^2}x + t_2\right) - \gamma\left(-\frac{v}{c^2}x + t_1\right) = \gamma(t_2 - t_1)$$

where the coordinate x of the punctiform clock is the same;

- For the length contraction, the situation is more delicate. If we consider the points of coordinates x_1 and x_2 at a given time moment t, one has again:

$$x_2' - x_1' = \gamma(x_2 - vt) - \gamma(x_2 - vt) = \gamma(x_2 - x_1).$$

Apparently, this means length contraction. But the events (x_1, t) and (x_2, t) are transformed in events (x_1', t_1') and (x_2', t_2') with $t_1' \neq t_2'$ because of the coefficient $\delta_{SS'} \neq 0$. It does not really make sense to speak about the distance between a point which is here and now and a point which is there at another moment, when we translate space-time coordinates from a moving frame. Some classical proofs of the relativist speed addition law have the same issue;

- What does it happen with a spinning wheel? Is there any slice which is contemporary with the observer? Then what happens where past slices approach future slices?

- As we cannot be contemporary with any moving body in its totality, it can be considered that effects like length contraction or relativity of the mass are badly posed problems. I cannot speak about the length or a mass of a body which does not consist anymore of contemporary slices. One [21] proves that the length contraction is seen in the Minkowski space as length dilation, and this is explained by the local Euclidean character of the Minkowski space. If it does really exist, length contraction is a much subtler phenomenon as time dilation.

- Consider the following thought experiment: Assume that a train runs on a track and the pantograph of the train goes up and touches the power line at the front *F* of the train, so sparks occur. An observer in the middle of the train will observe this event once in the frame of the train, considering the touching point as point of the train, and once in the frame of the power line, considering the touching point as point of the power line. Consequently, if perception is done only over the Lorentz transformation, the observer will see two different events, at two different time moments. In fact, she can observe just one event only if we use the Galilean transformation.

Hence, we are not allowed to overlap reference frames. The problem arising here is that a geometric point of the space gets two different meanings if considered to belong to (the spaces of) two relatively moving frames. Consequently, we are not allowed to consider interactions across different frames, if they are in relative movement. As it is not suitable either for moving bodies, nor for interactions across inertial frames, we can seriously ask if the Lorentz transformation is really an adequate model of movement;

- We repeat the experiment with two pantographs, one at the rear R and one in the front *F*:

The observer resting in the middle of the train sees the sparks from R and F in the same time if he considers them to be emitted by points of the train, as he is resting relatively to them. He sees the sparks from R and F in different moments if he considers them to be emitted by points of the power line, because he is moving relatively to them;

The observer resting in the middle of the segment RF of the power line (a bird) sees the sparks from R and F in the same time if he considers them to be emitted by points of the power line because he is resting relatively to them. He sees the points in different moments if he considers them to be emitted by points of the train, because he is moving relatively to them;

The Lorentz transformation will project them at different times from a frame to the other, although in the frame itself they are simultaneous. The problem here is that every event gets a different meaning when attributed to a moving frame or to the other moving frame. The problem is really unsolvable if in the model there is no absolute space, but just moving frames.

In conclusion, the STR as an axiomatic construct can be developed only at a level of abstraction, which makes it not useful for the concrete physics. On the other hand, the so-called application is done without any care about the framework in which they are done, and about to what extent the hypotheses of the theory are really fulfilled. This started already with the axiom of the Constancy of the Speed of Light, which is stated without any care of the meaning of notions like space, time and motion, as they are used in its statement (although the constancy of c could be related to the speed of sound in a space considered as a substrate [3]).

Thus, it seems this is the best that one can do in order to produce a model of STR: an abstract construct with only little physical meaning. We cannot exclude that better and stronger models of STR would be possible, but they are just not done so far.

7. General Theory of Relativity

Unlike his followers, Einstein was not happy with the loss of acceleration in STR. He was better than even the classical dynamics researchers who developed a most incoherent theory of collisions. In the world of classical dynamics where masses are always under acceleration due to the gravitational force, they developed a theory of collision in which masses move with constant speed and collide. Their argument is such that as the magnitude of the gravitational forces around us are negligibly small, we can ignore it. But the most basic assumption of dynamics is the point mass assumption and this means that the gravitational force among them will diverge when they collide. Under the flag of "precise most science" this kind of total nonsense has been accepted for centuries.

Einstein, ignoring the "followers" such as Heisenberg, went on to develop a new theory of relativity in which he could discuss accelerating frames. Einstein introduced the concept of "inertial forces". Assume a spaceship is in inertial motion in our reference frame. Then a force accelerates this spaceship with rate α. A body with a mass m in the spaceship experiences a force f, which is due to the acceleration of the spaceship, which makes the body m move with an acceleration of rate a "inside" the frame of the spaceship. [Putting aside what this force f is, this means $f=ma$.] Then from our perspective, m in the spaceship experiences the acceleration with rate $a+\alpha$. So, m will experience a force $f = m(a + \alpha)$. So,

$$f - m\alpha = ma. \tag{7.1}$$

This means that "from our perspective" the acceleration α on the spaceship induces an "additional" force $-ma$ on m, which he called "inertial force", upon the mass m and the equation (7.1) yields the force that the mass m experiences in the accelerating frame of the spaceship. Thus, Einstein claimed to be the second law in the accelerating frame of the spaceship. According to him, upon the modification of f to $f - m\alpha$, the second law is conserved under the choice of accelerating reference frames.

Clearly there is a confusion in the reference frame analysis in this argument of Einstein. Einstein assumed that f is the force that m experiences in the reference frame of the spaceship due to the acceleration of the spaceship. Then he says that it is $f - m\alpha$. In any mathematical sciences but Physics, this constitute a "contradiction"

$$f - m\alpha = ma = f. \tag{7.2}$$

All of his development of the General Theory of Relativity (GTR) is based upon this Equivalence Principle. Hence, the entire development of GTR has a significant crack…

8. Quantum Mechanics

Contrary to the common myth that QM is an anti-thesis to SRT, STR played a key role in the development of Quantum Mechanics. We will present the history of the development of QM.

8.1. Relativistic Theory of Photons

1. The problem of black body radiation showed a fundamental discrepancy between the theory of EM waves and the experimental result. Following the old tradition of empirical science that in case theory and experiment do not agree we have to change the theory, Planck amended

theory of EM radiation proclaiming that the minimum energy unit for an EM wave with frequency ν is $E=h\nu$ where h is the Planck constant. Curiously, Planck himself never believed in this hypothesis. He said that it was just a mathematical trick to do curve fitting invented under desperation.

2. It was Einstein who took this convention of Planck seriously and he proposed that $E=h\nu$ represented a particle called photon, which carries energy $h\nu$. He called it a photon. Following the hypothesis of STR, he claimed that this particle moved with the speed c. To avoid the relativistic energy (or mass) of this particle diverges, he assumed that the rest mass of photon was 0. There is a serious conceptual incoherence here already. A photon never stops. Why it has the "rest" mass which is zero. The concept of rest mass does not apply to photons. Unlike philosophers or pure mathematicians, physicists in general may not care much about these conceptual issues. But in reality, this will bring us to a lot of problems as we will observe in what follows: Relativistic energy equation for a photon thus becomes

$$E = \left(\frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \right) c^2 = \frac{0}{0}. \qquad (8.1)$$

As $0 \cdot x = 0$ can have any number as its solution, Einstein concluded that 0/0 is indefinite (any number) and took an opportunity to set

$$E = \frac{0}{0} = h\nu. \qquad (8.2)$$

This is a serious and elementary mathematical error that David Hilbert failed to detect. $0 \cdot x = 0$ having any number as its solution does not involve division by 0 and 0/0 involves division by 0. Indeed, assuming 0/0 being a number will cause a contradiction. / is a fraction and so it must follow the laws of fraction. So, we have

0/0 × 3 = 1× 3 = 3, 0/0 × 3 = (0×3)/0 = 0/0 = 1. (8.3)

But maybe we encounter here with the transition from continuous to discrete?

3. Einstein drove the following energy-momentum equation from $E = mc^2$:

$$E = \sqrt{p^2c^2 + m_0^2c^4}, \tag{8.4}$$

which seems to be false in the framework of pure relativistic formalism. With this equation, he drove the following results on photons:

$$E = \sqrt{(pc)^2} = pc = h\nu, \tag{8.5}$$

$$p = h/\lambda. \tag{8.6}$$

where λ is the wavelength. This is called "energy-momentum relation for photons". Here is another contradiction hidden. From the assumption 0/0 = $h\nu$, it follows

$$E = \sqrt{p^2c^2} = \sqrt{c^2m_0/\sqrt{1 - \upsilon^2/c^2}} = \sqrt{(h\nu)^2} = h\nu. \tag{8.7}$$

It seems, this conclusion is also related to the transition from a continuous to a discrete spectrum. This is only the possibility to resolve the present problem 0/0. But what is the reason for the transition and how it can be described mathematically?

8.2. De Broglie's Pilot Wave Theory

1. This theory was important as the double slit experiment urged physicists to come up with workable wave-particle duality regarding the light. Inspired by the work of Einstein, de Broglie demonstrated a coincidence of the particle and wave parameters, which was interpreted by the majority of physicists as a real wave-particle for very small particles. This allows one to easy interpret the diffraction phenomenon and double slit experiment for general particles. De Broglie transformed a mathematical plane wave with wave vector (k_X, k_Y, k_Z) and angular frequency ω by Lorentz transformation and obtained

$$k'_x = (k_x - \upsilon(\omega/c^2)/\sqrt{(1-\upsilon^2/c^2)},$$
$$k'_y = k_y,$$
$$k'_z = k_z,$$
$$\omega' = (\omega - \upsilon k_x)/\sqrt{(1-\upsilon^2/c^2)}. \qquad (8.8)$$

Drawing an "analogy" of this to the transformation of momentum and energy,

$$p'_x = k_x - \upsilon(\omega/c^2)/\sqrt{(1-\upsilon^2/c^2)},$$
$$p'_y = p_y,$$
$$p'_z = p_z,$$
$$E' = (\omega - \upsilon k_x)/\sqrt{(1-\upsilon^2/c^2)}, \qquad (8.9)$$

he got

$$p = \hbar k, \;\; E = \hbar\omega \qquad (8.10)$$

for the momentum and energy of the particle, which also became true for some wave associated with it. This laid a foundation for the Quantum Mechanical (QM) wave particle-duality. What is astounding here is that mathematical plain waves are given energy and momentum only through above mentioned "analogy" between the (**k**, ω) of plain wave and (**p**, E) of particle.

All of this naturally leads to some serious crisis. From this theory based upon the above mentioned mathematical analogy only, one can conclude that unless the phase speed of a wave is the same as its group speed, either phase speed or group speed exceeds the speed limit c. De Broglie's answer to this criticism was that waves carried energy only with its group speed, so it was correct to have its phase speed exceeding speed limit c. There was some serious reason why de Broglie's pilot wave theory was controversial. The wave-particle duality was established by de Broglie only on the basis of mathematical analogy regarding the Lorentz transforming. It was almost unthinkable that Schrodinger used de Broglie relation above to bang out the so-called Schrodinger's wave equation which laid the first foundation for QM. Thus, it seems contrary to the common belief, QM is very closely bound up with STR.

8.3. Schrödinger's Wave Mechanics

1. Schrödinger adopted the Einstein's ill-fated relativistic theory of photons as the theory of wave-particle duality for light waves (EM waves). Using the uncertainty in counting the number of the cress of a wave in a fixed time interval light wave, he obtained the uncertainty of (frequency, time) measurement for the EM waves and applying $E = h\nu$, he obtained the uncertainty of the measurements (energy, time). Applying the relativistic momentum and energy relation of Einstein to photon, he obtained the uncertainty of (momentum, location). All of this constitute Schrödinger's wave mechanics for photons.

2. Schrödinger then combined Hamilton's classical energy equation for a particle with de Broglie's wave to obtain the so-called Schrödinger wave equation that is the wave dual of the particle. By considering the uncertainty in the measuring of the number of cress passing in a time interval he obtained the uncertainty of (energy, time). Similarly, he obtained the uncertainty in measuring (momentum, location).

8.4. Heisenberg's Matrix Theory of Quantum Mechanics

1. Heisenberg was unhappy about the quantum mechanics of his time, which was based upon the measurements of frequency and location (that are not measurable). So, he launched the formalism of QM, which is based upon measurable quantities. This move was consistent with the trend of positivism and instrumentalism among his contemporaries.

2. Heisenberg looked for an answer to this problem in the failed Bohr's correspondence principle. According to this principle of Bohr, there is a close connection between the quantum transition (in old QM) of an oscillating system and the Fourier components of the oscillating motion in the sense of classical mechanics. However, this correspondence gives the right answer only when the quantum number is large.

3. As a solution to this shortfall of Bohr's correspondence principle, Heisenberg tried to find a new correspondence principle that yielded correct predictions for all quantum numbers.

4. In the end, Heisenberg came up with desirable infinite matrix representation of physical quantity and coordinate using Fourier components with which he converted Hamiltonian equation of motion into infinite matrix version of canonical equation of motion:

$$dp/dt = 2\pi i/h \cdot (pH - Hp); \tag{8.11}$$

$$dx/dt = -2\pi i/h \cdot (xH - Hx). \tag{8.12}$$

The first equation describes the quantum systems as a Hamiltonian operator. The second equation describes the canonical equation of motion. With them we calculate the absolute values of the amplitude of p and x. Also, we calculate the frequency of the phase of p and x.

5. Furthermore, Heisenberg showed "empirical equivalence" of his QM and Schrödinger's QM. Physicists argue that the first equation, which is coming from Hamilton's classical equation plus Bohr's correspondence Principle, and the second one, which is coming from the Hamiltonian classical equation plus de Broglie's relation, are empirically equivalent;

they have established that something at least empirically intrinsic is achieved.

6. Again, after all, all of this is invalid as to begin with the classical energy concept is invalid to begin with. Moreover, Schrodinger's wave mechanics is invalid as discussed in Sects. 8.3.1 and 8.3.2. One may question if Correspondence Principle and Pilot Wave Theory are equivalent. Considering that the pilot wave theory is logically inconsistent, we must conclude that this question is meaningless as by virtue of inconsistent theory this theory can imply any theory.

7. What about the question of Heisenberg's QM itself? Putting the issue of energy concept aside, it did not use de Broglie's relation. So, may it be the case that it means something as the only problem with it seems to be that of correspondence principle? Bohr seems used the photon/(EM wave) duality for his early quantum mechanics.

Without this false assumption, QM does not exist.

8.5. Photon/EM-Wave Duality Revisited

We may add more problems to the claimed duality between photons and EM waves. According to the Uncertainty Principle, a particle cannot be localized twice. This makes it theoretically impossible to do the Michelson-Morely experiment. The photon is localized at the mirror and then at the emitter of the photon. The first equation (8.11) describes the quantum systems as Hamiltonian operator.

8.6. Von Neuman's Formalism

Upon the crisis of too many theories of Quantum Mechanics, von Neuman launched a project to put at least three different but important ideas together, namely Schrödinger's, Heisenberg's and Born's. He started with Schrödinger's wave equation upon complex Hilbert space and, reflecting Heisenberg's matrix formalism, represented empirical measurement as self-adjoint operators over the Hilbert space. The restriction to self-adjoint operators is simply because he wanted to use eigenvalues of the operator as possible outcome of the measurement and this condition guarantees that the eigenvalues are all real numbers. This process of representing measurements as self-adjoint operators is called “The First Quantization”. From this point on, von Neumann’s formalism and Schrödinger’s formalism diverge. Due to the eigenvector theory, the quantum state, which is a point in the complex Hilbert space, reduced to eigenstate. Nevertheless, Schrödinger himself found this approach unacceptable.

The problem here is not limited to just the state reduction. Of course, Schrödinger had all reasons to question this reduction of state, which seem to have little ontological relevance. Moreover, it is clear that we have not ontological justification of the claim that eigenvalues are the possible outcome of the measurement represented by the self-adjoint operator.

Von Neuman adopted Born’s idea and associated the probabilistic distribution to the eigenvalues. With this, he showed his own version of uncertainty principle that came from Schwaltz’s inequality of functional analysis. His uncertainty principle covers (momentum and location) but does not cover (energy and time) as in Heisenberg’s and his formalism time is not observable.

Due to the nature of self-adjoint operators, once a measurement is applied, the quantum state reduces to its eigenstate and subsequent application of this measurement will not change the quantum state. Algebraically this is to say that self-adjoint operators are “idempotent”. The ontological meaning of this is not clear at all. The concept of subsequent application is not related to the physical time. It is a pure algebraic concept. Moreover, Kitada and Fletcher [22] and Kitada [23] showed that unless the eigenstate is “scattering state” the quantum state gets stuck at the eigenstate. This has no ontological interpretation either. This problem is a good example of the mismatch between ontology and mathematics. Mathematics we use for the study of ontology may well transcend ontology. Too “liberal” usage of mathematics in ontological science should be cautioned.

9. QUANTUM FIELD THEORY

9.1. Relativistic Quantum Mechanics

Schrodinger was not happy with his own wave mechanics because his wave equation is not invariant under the Lorentz Transformation. Oddly, Schrödinger's wave mechanics that came from de Broglie's relation, which is relativistic, failed to yield a relativistic theory (nevertheless, see Ref. [3]). Frustrated with this, Gordon-Klein banged out a "relativistic" Quantum Mechanics by replacing energy and momentum variables of Einstein's energy-momentum relation with energy operator and momentum operator over complex Hilbert space. By this time, the so called "quantization" was reduced to just replacing classical variables with operators over complex Hilbert space. This "revolutionary" work had one serious short fall that no theoretical physicists wanted to know. The momentum-energy relation of Einstein is false as it came from the violation of the fundamental restriction that in gamma factor the velocity v must be a constant to avoid contradiction coming from the violation of action-reaction law. Moreover, Dirac did not know that the concept of energy in theoretical physics is ill-defined. The work needed to accelerate from $m\cdot 0$ to $m \cdot v$ needs not be $mv^2/2$. Notwithstanding, Dirac, whom physicists call a mathematician and mathematicians call a physicist, used this Gordon-Klein quantum energy-momentum relation to obtain relativistic version of Schrödinger's equation for free electron.

This started a revolution in theoretical physics, which lead to what is now called Quantum Electro Dynamics. From this Dirac drove a rabbit ("anti-electron") out of bush. Apparently, Dirac had two fundamental theories of theoretical physics "relativistic". The classical EM theory is relativistic in the sense that it is invariant under the Lorentz transformation. Schrödinger's wave equation for electron is relativized in the same sense.

9.2. The Second Quantization

Starting with the relativistic theory of EM field, Dirac induced a new quantization of EM waves, new concept of photons. He Fourier expanded the vector potential to yields photons of new kind. Unlike Planck-Einstein's photons, his photons came directly from the formalism of Maxwell's EM field theory. His new photons are equipped with creation operator and annihilation operator.

It is unfortunate that virtually no study was made to investigate the relation between these two types of photons used in QED. Considering that Planck-Einstein photons lead to contradictions and there is a consistent explanation of the black-body radiation without using the concept of photons, it is hard to believe that Dirac made any attempt to connect his photons and Planck-Einstein's photons. It may well be the case that the contradiction in between the EM field theory and action reaction law alone created these illegitimate photons. Physicists should learn the grave consequences of illogical thinking, which leads to contradictions.

To make the matter even worse, Dirac took an analogy to the development of his photons as above and developed a new quantization of Schrödinger's waves. By quantizing Schrödinger's wave functions using Fourier expansion of Schrödinger waves, he induced particles representing Schrödinger waves. In this way, he reduced the whole system of quantum particle under the influence of Schrödinger's wave to a system of quantum particles removing the role of Schrödinger's waves. This development is called the "second quantization".

Clearly the second quantization for EM field failed. This is not a surprise when we consider the fact that the theory of EM field itself is inconsistent. Exactly the same comment applies to the second quantization of quantum field as Schrödinger's wave equation.

Schrödinger's wave mechanics is logically inconsistent after all. What do we expect from quantizing wrong equations to begin with?

10. EMPIRICISM V.S. PHYSICS

10.1. Newton vs. Empiricists

In principle, all physicists agree that Physics is an “empirical science” and so when a theory and experiment do not agree, or equivalently theory contradicts experiment, we conclude that the theory is refuted. In contrast, as mathematics is a conceptual science, when the theory is shown to be logically inconsistent the theory is refuted.

Historically, the founder of classical dynamics, Newton, was against the position of empiricism. He was a theologian of orthodox faith and for him physics was a part of Orthodox theology as logic was a part of Catholic theology. For Newton, the physical universe is absolute and could be observed only from outside without using physical means. He said that he was standing on the shoulder of God. Newton’s concern on empiricism was seconded by Goethe who pointed out that any measurement we make inside the physical universe affects the state of universe. This concern of Goethe was adopted later by Heisenberg who considered the issue of uncertainty.

10.2. Modern Philosophers vs. Empiricists

The 20th century philosophers such as Russell, Popper and Kuhn gave a stern warning to the confusion emanating from the connection between experiment and theory in the context of modern day theoretical physics. Popper said, as by virtue an inconsistent theory can predict anything, it is useless and has to be rejected. He also said that one cannot verify a physical theory as it requires infinitely many experiments to verify infinitely many predictions the theory makes. On the same token, we can even say that we cannot empirically verify even a single prediction which contains even a single variable as we have to experiment for all possible values of the free variable requiring infinitely many experiments. Kuhn further pointed out that when it comes to probabilistic theory such as QM, we cannot verify even a single prediction because, due to the large number theory, one has to carry out infinitely many experiment to verify it.

The most devastating warning on empiricism to Physics came from Russell who pointed out that the so called empirical verification of a theory is a vicious circle as such experiment uses the theory to be verified. He also said that the empirical refutation of a theory is contradiction as the experiment used must use the theory to be refuted.

This warning from Russell brings us straight back to three centuries ago when Newton started his classical dynamics. Newton's position was very clear on this. In his classical dynamics, one cannot put an observer on any mass in the absolute space as it violates the action/reaction law. He put an observer out of the absolute physical space. Measurement was not physical process but it was metaphysical process. History shows that it was not scientifically legitimate argument, which settled the issue among physicists. As a reaction to the "absolutism" of the middle age, "relativism" of Galileo won and Newton's warning was ignored. Since then scientific legitimacy was twisted into "empirical reasoning". The Empiricism and Relativism became a new absolute religion to rule.

10.3. Particle Accelerators?

What Russell warned is legitimate. When we measure the mass, we definitely assume the Newtonian theory of gravity. Things get even more alarming in Quantum Physics. According to the theory of QM, due to the Uncertainty Principle, when we localize a particle, it turns into a wave and it loses particle characteristic. This is how they explain the double slit experiment. This simply means that there must be no trajectories in the Wilson Chamber. Trajectories were created by continuous collision (localization) of an accelerated charge with water molecules. Here the resolution of localization is much-much higher than that of going through a slit on a wall. So, the charge must lose its particle nature way more than the particle in the double slit experiment.

More alarmingly, their calculation over the trajectories is flawed in two major senses. First, the calculation does not include the effect of collisions between the accelerated particle and the water molecules inside the Wilson chamber. This must be the most important collisions whose effect is completely ignored in their calculation. More seriously, the speed and momentum of the particles inside the Wilson chamber are calculated using the theoretical formulas of the QED. This is the single reason why these formulas are "verified" each time they do the "experiment". It is what logically minded people call "vicious circle". It appears that for "empiricists" like Physicists this is not a problem. For them, QED is the "most empirically verified theory" in the history of physics.

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