

Relativistic Dynamics Of Field-Particle System

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Abstract

This paper introduces a new relativistic approach based on treating any uniformly moving object as a quasi-static harmonic oscillator in a residual force field, the object being in equilibrium at all times, its different phases can be represented by a continuous state diagram in phase space. Based on these diagrams we introduce the concept of Dynamic Reference Frames in which physical phenomena take place. As a result of this approach, a deeper insight into the basic concepts such as mass and charge are gained and the dual nature of particles is revealed to be a consequence of observational relativity.

Key words: Relativity, Duality, Conservation, Charge, Mass

1. Introduction

The brief discussion of reference frames concept presented in this introduction is necessary in our opinion for the introduction of the new concept of Dynamic Reference Frame. This concept is the physical equivalent of the Newtonian absolute space and time.

1.1 Absolute relativity of Inertial Reference Frames

In Newton's classical theory, any process is eventually the direct interaction between material objects (pull, push and collision) taking place in the uniform, isotropic and empty absolute space with absolute and mathematical time, these interactions are represented by linear equations (Newton's laws and Galileo's transformations). Newton's Absolute Space (NAS) contains no other forms of existence besides the interacting material objects and contains no action carriers, which intermediate the interactions observed. Here, we formulate the following postulate:

NAS as an abstract entity is immovable and stationary in respect to all and any observer. This postulate is implicit in Einstein's second postulate, in fact, the latter is based entirely on the former in the sense that light travels in this space at a constant speed c , the space being stationary in all IFRs, and then the speed of light is the same in all IFRs. The difference between the two postulates lies in the fact that NAS is an abstract while an electromagnetic field is a material entity.

This characteristic of NAS (being at rest in all reference frames) enables all observers to identify their reference frames with The Absolute Reference Frame presumably connected to NAS, without having to prove its physical existence. In this context, any (IFR) is a mathematical and arbitrary representation of this absolute reference frame. This we call Absolute Relativity, since observations made by any observer are absolute from that observer's point of view and, at the same time, are relative from the point of view of other observers situated in other frames.

1.2 Limit-ness Of Signal Velocity

Extending NAS to the gravitational processes posed the problem of conserving the internal consistency of the theory, either by assuming a constant velocity for action transmission thus, adopting the particle-field-particle model of interaction (which would have been unjustified and unknown by the experimental base then prevailing) or, adopting the action-at-a distance concept which was then the only conceivable measure, although logically disturbing but experimentally uncontested. So the result

was consistent with the postulates namely, the particle-particle interaction, unlimited relative velocities, and all IFRs are absolutely equivalent.

2. The Physical Sequence Of Events In Thought Experiments And Proper IFR.

Although elementary as it may seem, we first examine the process of observation of events involving signals with limited velocity (light) made by different observers. This examination is of extreme importance for our discussion; the physical sequence of events in thought experiments should be accurately presented in order to reach meaningful conclusions. Respecting the right physical sequence of events in the following experiment shows that, an abstract (physical) background common to all observers will facilitate incorporating the propagation of light by treating it in the same way as mechanical waves which, accept one proper velocity and any number of apparent velocities.

2.1 Proper Reference Frame Of Light

Considering an experiment attempting to measure the velocity of light, the same velocity c will be registered in any frame provided that transmitter, observer, and receiver/reflector are all at rest in that frame (velocity of light can only be measured in a closed path with the ends of the path at rest relative to each other). Call this class of inertial frames the proper IFR. Another observer situated in some other IFR may register any other velocity v depending on the relative velocity of the considered IFRs. The measurements made in one of the IFRs could be transformed into the other IFR with the new relativistic velocity addition rule we introduce below (see 4.4). The analogy with the proper reference frame adopted to accommodate mechanical waves in classical mechanics is obvious, in the latter case the medium is at rest in the proper frame while in the electromagnetic waves case the closed path, and its components are at rest in the proper frame.

As for other observers in IFRs moving relative to the proper one, they deal with signals (other light particles than the ones involved in the experiment) sent from the proper frame to different receivers situated in different points in their reference frames, these signals announce the start and finish of events in the proper IFR.

2.2 Proper And Apparent Velocities Of Light

In more detail, in the case where the event consists of sending a light signal back and forth between a transmitter and a receiver/reflector both at rest in the proper IFR (K' in Fig.1), at the moment when the origins of frames K and K' get close enough so as to consider the separating distance between them to be negligible (this is the physical equivalent of the more mathematical phrase at the moment when origins coincide)¹, the transmitter fixed to the origin O' of frame K' sends two signals, one towards the receiver/reflector R' and one to the observer fixed to origin O of frame K moving with velocity $-V$ relative to K' announcing the event (Fig.1).

Once the signal is received/reflected at R' , a separate signal simultaneously with the reflection event is sent to the relatively moving frame to announce the event. Back at O' the reflected signal is received and another signal is transmitted to the observer in frame K simultaneously with reception event. This is the well known thought experiment from which relativity of length interval readings is obtained, with one important difference from the way it is presented in text books that is, observers in frame K do not follow the movement of the signal directly and instantaneously, but as in physical reality, by receiving informing signals. Every time a signal is emitted or

¹ This distinction between the physical and mathematical conditions is extremely important when micro processes are studied, where the period and wavelength of the signals cannot be neglected.

received in the proper frame, a simultaneous signal is transmitted towards observers in the other relatively moving frame and as a result, these observers will register a relative velocity

$$v = c \sqrt{1 - (V/c)^2} \quad (2.1)$$

Equation (2.1) represents the geometrical mean of the two apparent back and forth velocities (closed path). In this approach, the phrase (proper reference frame) frequently used in the literature is given a physical meaning, in some what general terms, one can say that events happen in one reference frame but can be observed from other frames. It is worth noting that the nature of signals is irrelevant since we are examining a kinematical aspect of the process, the dual nature of light expresses it self during the dynamic interaction with other forms of matter acting as a particle in some instances and as a wave in others. What is of importance here is that the velocity of the signal that facilitates interactions is measured in a closed path.

So in case of thought experiments involving relativistic particles (light particles), the definition of the events with which different observers are dealing with, should be made in accordance with the physical sequence of events in reality.

One point to be emphasized is that when receiver and transmitter of light particles are moving relative to each other, none of the two could measure a velocity of the incoming (outgoing) particle directly, the absolute (proper) magnitude of light velocity can only be meaningful when measured by an observer at rest relative to both transmitter and receiver (in a closed path).

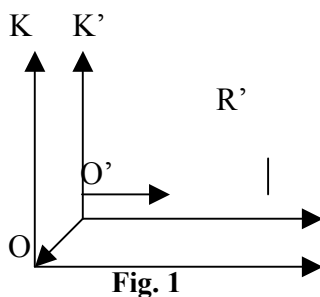


Fig. 1

Signal transmission at the initial moment

The dual nature of light is observed only in relative frames while, in proper frames the absolute wave nature is observed. This is the physical basis for the transversal Doppler effect; the relative change in the photon's total energy is the result of the relative change in the transmitter's phase (see below) while, for longitudinal Doppler effect we add the effect of relative velocity of the photon ($c \pm v$) (see 4.5), the wave-particle duality is a relative character of particles in general.

The observer in the relative frame cannot distinguish between the absolute and relative components of the total relative energy of the photon during a dynamic process. As we shall see below, the same argument applies to material particles where, the change observed in total relative energy of the particle is attributed to the relative change in the particle's nature (wave aspect in this case).

Since dual nature of light expresses it self in dynamics, we propose a treatment which allows smooth and continuous transition from dynamics to kinematics.

A real physical system is always composed of a material particle and a field in interaction, in the following approach we analyze the dynamics of such a system and project the results to the kinematics field.

Taking the last statement into consideration and adhering to the spirit of our approach that is, making clear distinction between the physical and the mathematical and,

respecting classical commonsense, we propose the following treatment of the subject beforehand.

3. Dynamic Reference Frames

3.1 Quasi-Static Process

Considering an isolated physical system comprised of a (residual) constant force field (the physical equivalent of NAS) and a material particle, the interaction between the two is represented by the state function equilibrium diagram of the particle in phase space. The system comprises the particle and the rest of the universe, the system being at rest and isolated, its total energy is constant and any process undertaken by the particle represents the transformation of the particle's potential energy into kinetic energy or vice-versa with the total energy of the system (universe) being constant. A process in which the variable x (velocity in our case) has changed by Δx over the period of time τ , is considered to be quasi-static if the rate of change $dx/dt \ll \Delta x/\tau$ (where dt is the proper time interval). In this case, the particle is considered to be in equilibrium in each instantaneous state (at rest or uniform motion in our case) for the period of time required by the observation process.

In the case of a normal process (accelerating particle), the condition $dt \approx \tau$ is implied and the instantaneous states of the particle are no longer equilibrium states therefore, the process cannot be represented by a segment on the state equilibrium diagram.

We define the dynamic reference frame (as opposed to inertial reference frame), as the equilibrium diagram representing the state function of the specific particle, undergoing a quasi-static process as part of an isolated and stationary system.

3.2 Proper Dynamic Reference Frame

The Proper Dynamic Reference Frame of a particle (as opposed to proper inertial reference frame), is the equilibrium diagram of the state function of that particle, where the variables are determined by the proper parameters of the particle (m_0, l_0, t_0), this implies that relativistic change in the total energy of the particle is absent, the total absolute energy of the particle (that proves to be equal to m_0c^2) is an invariant of the system.

4. Mechanics of an Isolated Stationary Field-Particle System in Quasi-static Process

As for the interaction of field-particle, although we study the field by the reaction of a material probe, both the field and the probe have independent qualities that may not be revealed during the interaction, what we observe are the characteristics of the system field-particle. We first define rest mass m_0 as a characteristic constant of the particle representing the ratio between the field's constant force F_f and the initial acceleration of the particle a_0 at $\mathbf{v} \rightarrow 0$, we also define F_f as a characteristic constant of the field equal to the product $m_0 a_0$.

The circularity of defining mass and force is broken by the empirical definition of field force based on a universal constant namely, the elementary charge.

Although force is not the most suitable concept for relativistic mechanics analysis, we base our introduction of the proposed approach on this concept for clarity and simplicity purposes. Equation (4.1) represents the mathematical form of the definitions mentioned above;

$$m_0 = \mathbf{F}_f / \mathbf{a}_0 \quad \mathbf{v} \rightarrow 0 \quad (4.1)$$

Accepting m_0 to be a characteristic constant of the particle, we attribute the change in the ratio in the right hand side of equation (4.1) at high velocities, to the change in the interaction mode between the particle and the field, i.e. the probes capacity to transform potential energy to Kinetic energy as a function of velocity:

$$m_0 = F_f / (a_i \cdot \gamma) \quad (4.2)$$

Where a_i is the instant acceleration acquired by the particle.

And $\gamma = 1/\sqrt{1-\beta^2}$ is a variable function of velocity with $\beta = v/c$.

Rearranging (4.2)

$$m_0 = ((1/\gamma(v)) F_f / a_i)$$

$$dv/dt \cdot 1/\sqrt{(1-\beta^2)} = F_f/m_0$$

where $dv/dt = a_i$

$$dv/\sqrt{(1-\beta^2)} = F_f/m_0 \cdot dt$$

Integrating the last equation gives

$$v = c \text{Sin}((F_f/m_0 c) \cdot t) \quad (4.3)$$

$$v = c \text{Sin}(\Phi) \quad (4.3')$$

The value $F_f/m_0 c$ represents a characteristic angular speed of the field-particle system.

Therefore, any object O moving at a constant velocity may be considered as a harmonic oscillator in quasi-static process of acceleration in relative phase (Φ).

In a phase space equilibrium diagram for a particle in an isolated stationary system characterized by (m_0, l_0, t_0) as shown in Fig. 2 below, any observer will be identified by a certain phase on the objects state function equilibrium diagram.

In Fig. 2, observer K' is moving with velocity v relative to observer K , so K' has a phase $(\Phi_2) = \arcsin (V/c)$ relative to K ,

4.1. Velocity Addition Rule

We deduce the velocity addition rule in the following way:

The object O moves with velocity $v' = c \text{Sin} (\Phi_1)$ relative to K' which in it's turn

moves with velocity $V = c \text{Sin} (\Phi_2)$ relative to K .

The velocity v of the object as measured by K is

$$v = c \text{Sin} (\Phi_1 + \Phi_2) \quad (4.4)$$

Knowing that,

$$\text{Sin} (\Phi_1 + \Phi_2) = \text{Sin}\Phi_1 \text{Cos}\Phi_2 + \text{Sin}\Phi_2 \text{Cos}\Phi_1$$

With simple trigonometric we get

$$v = v' \sqrt{(1-\beta^2)} + V \sqrt{(1-\beta'^2)} \quad (4.5)$$

Making $\sqrt{(1-\beta^2)} = 1/\gamma$ and $\sqrt{(1-\beta'^2)} = 1/\gamma'$

$$v = v'/\gamma + V/\gamma' \quad (4.5')$$

In the case of O being a photon $v'=c$ (K' is the proper reference frame of light) we get;

$$v = c \sqrt{(1-\beta^2)}$$

Which is the same relative light signal velocity observed in a non-proper frame in a closed path experiment. This relative velocity is the physical base of the relative change observed in a photon's total energy (the transverse Doppler effect).

In this dynamic approach, any moving material object can have any apparent velocity (up to c) when observed from any frame other than the proper one, in analogy with the proper velocity of light c the proper velocity of all material objects is 0.

In this figure, observer K identifies it self with phase $\Phi = 0$ and considers the velocity and unit length of K' to be equal to the projections on its coordinates:

$$UL'_{K'} = UL'_{K'} \cdot \text{Cos} \Phi_2 = UL'_{K'} \cdot \sqrt{(1-\beta^2)}$$

Which is the Lorentz contraction.

Several interesting results could be obtained from this method of treatment, for example, depending on the observer's relative phase, two moving identical objects may have the same velocity vector in a given dynamic frame and have equal but inverse acceleration vectors.

In case of a charged particle, different observers may detect different (negative, positive) charges for the same particle depending on the particular relative phase of the observer, leading to the conclusion that charge is a relative parameter (see 5 below).

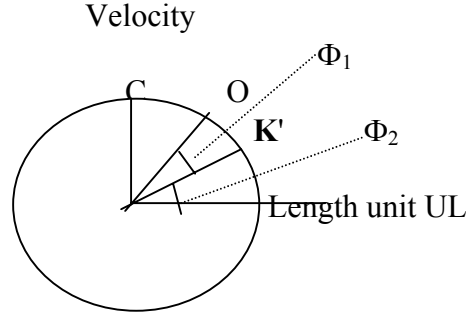


Fig. 2
Positions of Frames k, k' and particle O in phase space diagram

4.2. Energy of an Isolated Stationary Field-Particle System in Quasi-static Process

Making $v = dx/dt$ and integrating equation (4.3) we get:

$$dx/dt = c \sin((F_f/m_0c) \cdot t) \quad (4.3)$$

$$\int(dx) = \int(c \sin((F_f/m_0c) \cdot t)) dt \quad (4.6)$$

$$x = -((m_0c^2)/F_f) \cos((F_f/m_0c) \cdot t) + K$$

$$x \cdot F_f = -(m_0c^2) \cos((F_f/m_0c) \cdot t) + K \quad (4.7)$$

The left hand side of equation (4.7) represents the work performed by the residual constant force field on the particle from the point of view of an observer with phase $\Phi = 0$. Making $t = 0, x = 0$ and substituting in (5.7) we get the value of the constant K , $K = m_0c^2$ (4.8)

K is the total proper energy of the system (E_t).

The kinetic component of the total proper energy (according to observer $\Phi = 0$) of a particle with phase Φ (E_K), is

$$E_K = m_0c^2 \sin \Phi$$

$$E_K = m_0c^2 v/c = m_0c^2 \beta \quad (4.9)$$

The potential component being

$$E_P = m_0c^2 \cos \Phi = m_0c^2 / \gamma \quad (4.10)$$

A material object can have a relative velocity c which leads to a relative kinetic (phase) energy $E_K = m_0c^2$, the absolute (system) energy $E_t = m_0c^2$ is what the particle is capable of exchanging with any surrounding field directly.

The system energy is exchanged as a result of passing from one (proper) system to another. For example, the disintegration of a particle into two or more particles, represents passing from an initial system (field-mother particle) to a new system namely, field-resulting new particles (see 4.4 below).

4.3. Energy of a Moving Isolated Field-Particle System

From the point of view of an observer situated in a relative dynamic frame, the total relative energy E'_t (of the particle) is composed of a relative kinetic energy

component E'_k and an invariant potential (rest) energy component $E'_p = m_e c^2$. In figure 3, the inner circle represents the proper dynamic frame while the outer circle represents the relative dynamic frame.

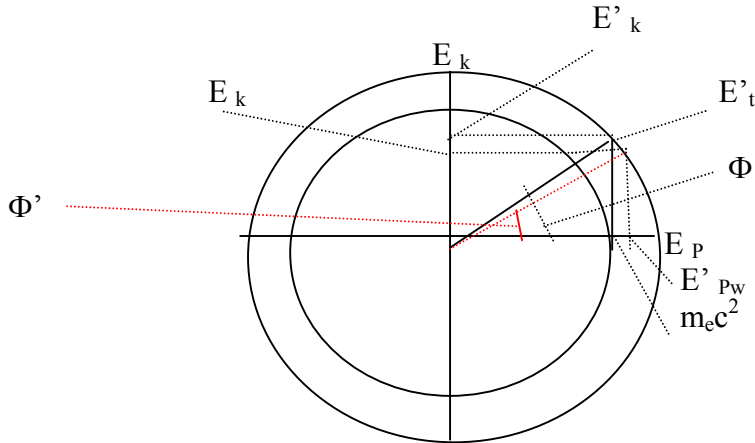


Fig. 3

Proper and Relative Dynamic Frames

For a particle with phase Φ , we have:

$$E'_t = m_e c^2 / \cos \Phi \quad (4.11)$$

$$E'_t = m_e c^2 \gamma \quad (4.11)$$

$$E'_k = m_e c^2 \beta \gamma \quad (4.12)$$

The E'_k component of the total relativistic energy is obviously the sum of two distinct subcomponents, a kinetic subcomponent attributed to the particle nature ($E_k = m_e c^2 \beta \gamma'$), and a potential-like subcomponent ($E'_{pw} = m_e c^2 \gamma / \gamma'$ where $\gamma' = 1 / \cos \Phi'$) attributed to the (relative) wave nature experienced by the observer in the non-proper frame.

4.4. Energy Conservation in Particle Disintegration

Next we investigate the disintegration of a neutron n into a proton p and electron e . In Figure 4a the state equilibrium diagram of n (the outer circle) and the state equilibrium diagram of p (inner circle) are plotted. On the diagram of n , the points n , p , and e represent the state of n before disintegration (at rest), and the relative states of p and e required to conserve the momentum in the frame of n .

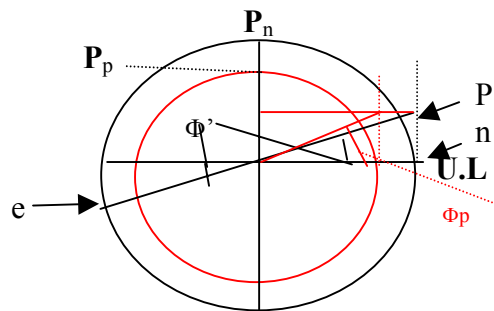


Fig. 4.a

Dynamic Reference Frames of the initial particle n with relative positions of p and e and proper frame of particle p .

In this illustration, the positive direction of n and p coincide, and in the context of the initial frame (proper frame of particle n before disintegration) p and e should have Φ' and $\Phi' + \pi$ phases respectively. The observer in this case identifies it self with the proper frame of the disintegrated particle and requires the momentum conservation to

be applicable in this (virtual) frame. For stationary observers in their proper frames, p and e will have Φ_p and Φ_e phases.

From figure 4.a we have

$$\mathbf{P}'_{p,\Phi'} = \mathbf{P}_{n,\Phi'} = -\mathbf{P}'_{e,(\Phi'+\pi)} = \mathbf{P}_{p,\Phi_p} \quad (4.13)$$

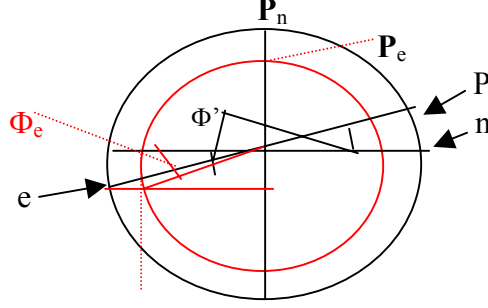


Fig. 4.b

Dynamic Reference Frames of the initial particle n with relative positions of p and e and proper frame of particle e.

Figure 4b represents the setup for the neutron and electron state diagrams, similar to figure 4.a with the exception that, the positive direction in the electron's frame is inverted, we have

$$\mathbf{P}'_{e,\Phi'+\pi} = -\mathbf{P}_{n,\Phi'} = -\mathbf{P}'_{p,\Phi'} = \mathbf{P}_{e,\Phi_e} \quad (4.14)$$

In their proper state diagrams, p and e have the momenta \mathbf{P}_{p,Φ_p} and \mathbf{P}_{e,Φ_e} which must be equal and opposite in a conservative field:

$$\mathbf{P}_{p,\Phi_p} = m_p \mathbf{c} \gamma_p \text{Sin } \Phi_p = m_p \mathbf{c} \gamma_p \beta_p$$

$$\mathbf{P}_{e,\Phi_e} = m_e \mathbf{c} \gamma_e \text{Sin } \Phi_e = m_e \mathbf{c} \gamma_e \beta_e$$

$$\mathbf{P}_{n,\Phi'} = m_n \mathbf{c} \gamma' \text{Sin } \Phi' = m_n \mathbf{c} \gamma' \beta'$$

From (4.13) we have

$$m_p \mathbf{c} \gamma_p \beta_p = m_n \mathbf{c} \gamma' \beta'$$

$$m_p / m_n = \gamma' \beta' / \gamma_p \beta_p$$

$$(4.15)$$

Similarly from (4.14)

$$m_e \mathbf{c} \gamma_e \beta_e = -m_n \mathbf{c} \gamma' \beta'$$

$$m_e / m_n = -\gamma' \beta' / \gamma_e \beta_e$$

$$(4.16)$$

Adding up (4.15) and (4.16) we get

$$(m_p + m_e) / m_n = \gamma' \beta' / \gamma_p \beta_p - \gamma' \beta' / \gamma_e \beta_e$$

$$(m_p + m_e) / m_n = \tan \Phi' (1 / \tan \Phi_p - 1 / \tan \Phi_e)$$

$$(4.17)$$

The right hand side of equation (4.17) is greater than unity since $\Phi' < \Phi_p \ll \Phi_e$

which leads to the obvious conclusion that, for the momentum and energy

conservation to hold true in the virtual frame n, i.e. $E'_p + E'_e = E_n$, observer in the

virtual frame of n is required to assume a third (virtual) particle to make up for the

difference between the sum of energies measured in the proper frames $E_p + E_e$ and

the sum $E'_p + E'_e$.

An important conclusion to be drawn from the above discussion is that, in the general case of interacting particles, the interaction energy is not a result of direct mass to energy conversion, rather it is the difference in energies of two (real) systems; the first comprised (in the previous example) of field-electron-proton and the second comprised of field-neutron. In this case a totally new entities are formed as a result of interaction (disintegration).

4.5. The Doppler Effect

As mentioned earlier, the total Doppler effect in the case of electro-magnetic waves comprises two components. The first component (the transversal effect) is attributed to the difference in relative phases of the transmitter and receiver regardless of the relative direction of motion, the second component (the classical effect) is attributed to the relative velocity and direction of the photon it self. Figure 5 illustrates the case of an oscillating electron in its proper frame and, the relative frame in which total relative energy equals $E'_t = m_e c^2 \gamma$ with two positions Φ_1 and Φ_2 (velocities v and $-v$).

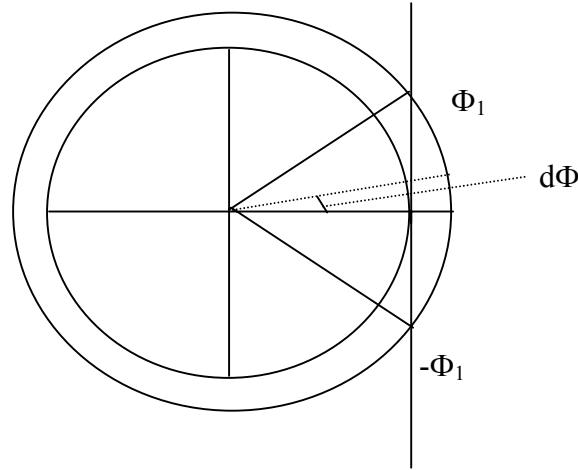


Figure 5

Doppler effect in the case of a radiating electron. Oscillation period $d\Phi$

The electron oscillates between Φ_1 and $(\Phi_1 + d\Phi_1)$ in position 1 moving away from the observer (situated in the proper frame at phase 0) and between $-\Phi_1$ and $-(\Phi_1 + d\Phi_1)$ in 2 approaching the observer. At $\Phi = 0$, change in the electron's kinetic energy equals $dE_k = m_e c^2 \sin d\Phi$ in the proper frame and, $m_e c^2 \gamma \sin d\Phi$ in the relative frame.

The change in the total energies above equals the transmitted photon's energy as seen from the respective frames. Making $dE_t = h\nu_0$ and $dE'_t = h\nu$ where h is Plank's constant and ν, ν_0 are the proper and relative photon frequencies and, considering the last four equations we get

$$\nu = \nu_0 \gamma = \nu_0 / \sqrt{1 - \beta^2} \quad (4.18)$$

Equation (4.18) represents the transversal Doppler effect attributed to the relativity of transmitter, receiver phases, regardless of their direction of motion.

Taking in to consideration the proper to relative velocity ratio of the photon $c/c-v$ ($1/1-\beta$) for the case of electron moving away and $c/c+v$ ($1/1+\beta$) for the case of electron approaching the observer we get;

$$\begin{aligned} \nu &= \nu_0 (1/\sqrt{1-\beta}) \sqrt{1+\beta} (1+\beta) \text{ which leads to;} \\ \nu &= \nu_0 \sqrt{(1+\beta)/(1-\beta)} \end{aligned} \quad (4.19)$$

Equation (4.19) is the total (longitudinal and transversal) relativistic Doppler effect in the case of transmitter and observer approaching each other.

In the same way we get the total relativistic Doppler effect for the case of transmitter-observer moving away from each other

$$\nu = \nu_0 \sqrt{(1-\beta)/(1+\beta)} \quad (4.20)$$

5. Relativity Of Electric Charge And Spin

Treating a particle in motion as a linear harmonic oscillator with variable phases provides a valuable insight regarding the understanding of particle characteristics. For this discussion in figure 6 we reproduce the proper equilibrium diagram of a charged particle in four different positions relative to the observer in phase $\Phi = 0$.

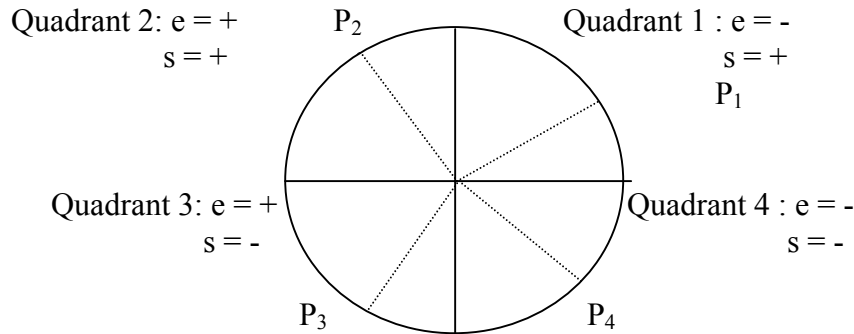


Figure 6

Illustration of charge and spin relativity

The observer in phase $\Phi = \tilde{0}$ observes the following characteristics associated with the particle's motion. First, the positive direction coincides with the direction of motion of the particle in positions P_1 and P_2 secondly, in position P_1 , the particle is quasi-statically accelerating in the positive direction of motion while in position P_2 , the particle is quasi-statically decelerating. Thirdly, in positions P_3 and P_4 , the particle is moving in the negative direction, while in position P_3 the particle is quasi-statically accelerating (in the negative direction), in position P_4 its quasi-statically decelerating. These characteristics are determined by the relative phase of the particle as seen by the observer. Obviously, for a certain observer in a given field, the acceleration direction of a charged particle is determined by the particle's charge ($e = +, -$).

A particle with opposite charge will be seen as accelerating into the opposite direction (by the same observer). If the directions of uniform motion (in a quasi-static process of acceleration) for both particles coincide, in this case we assign the same characteristic spin ($s = +, -$) to these particles. This approach provides a new base for classification of particles and the possibility of their interactions, for example, two identical particles in positions P_1 and P_3 can interact as particle-antiparticle while in positions P_1 and P_2 , the same two particles have zero probability of interaction.

6. Conclusions

Adopting Newton's abstract space in its dynamic (physical) version that is, the field-particle quasi-static interaction system and the relative phase concept, reveals the relativistic origin of the particle-wave duality of both electromagnetic waves and material particles. Moreover, respecting the actual physical sequence of events in think experiments leads to a clear distinction between proper and relative frames. The closed path method for determining the proper velocity of light signals leads to the dismissal of Einstein's second postulate and introduces relative light velocity, which is linked to the photon's relative particle nature. Finally, the whole approach presented in this paper provides valuable insights into different branches of physics; making it possible to interpret observed phenomena in line with classical commonsense.

