DEVELOPMENT OF THE GAUSS – WEBER ELECTRODYNAMICS QUANTUM MECHANICS WITHOUT WAFES

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The Gauss-Weber electrodynamics, preceding Maxwell's electrodynamics considered mutual interactions of charges instead of interactions with immobile ether. The discrepancy of Maxwell's theory with experimental data revealed after determining light velocity and quantization of electromagnetic energy lead to the creation of Special Relativity and the wave-corpuscular dualism. The following paradoxes are of a principal character. An attempt is made to revive the Gauss – Weber theory invoking the charge interaction interpretation of quantum physics. In so doing discrepancies are removed and several physical phenomena in Relativity and Quantum mechanic can be explained. Rejection of the wave theory removes paradoxes of the corpuscular-wave dualism. Results of experiments that are used to confirm the wave theory can be explained by the corpuscular theory. Propagation of electromagnetic rays we considered as propagation of the so-called "virtual particles" causing interaction of charges.

The statement made by Max Planck, that new ideas are firmly accepted by science only after appearance of a new generation of scientists brought up on these ideas [1], is properly justified by quantum mechanics.

If at the origin of quantum mechanics such fundamental propositions like the wave-corpuscular dualism, and the uncertainty relation have been widely discussed [2,3], they are not bothering investigators at present, being considered a long-explored area, a truism. According to L. D. Landau, quantum mechanics has achieved the status of a theory, "by its logic and harmony competitive with that of classical mechanics". And further "It is an official point of view occupying a highly important place in textbooks, academic publications, and encyclopaedia." It should be noted, however, that Landau presents in the same publication also a quite opposite view — "It seems that the foundations of the present theory need reconsideration" [4].

The problem consists not in that several incomprehensible points have at present been cleared, it is that one has become used to them. Moreover, these incomprehensible points have been "legalized" by introduced "laws", "postulates", "prohibitions", that appear not only to be correct, but also create the impression that no explanation is needed, and the problem is closed.

We face an intricate situation. According to history of science, certain branches starting with philosophy, separate itself from it with time. At present the process is reversed, mainly philosophy is investigating and discussing the quantum mechanics foundations, while official physics has put up with unsolved problems, or as mentioned earlier, considers them "legalized". This tendency has been started already by the founders of quantum mechanics by transferring these

problems to philosophy in order to remove them and to substitute the scientific approach by general reasoning.

Accordingly, discussions on the foundations of quantum mechanics lead often to an exchange of labels like “Idealism’, ‘Machism”, “Positivism”, ”Subjectivism”, etc. [3,5]. Analogies proving nothing and reference to authorities are used, so that no objective conclusions could be made.

Appreciation of various directions in such an important branch of physics as quantum theory, should be based on *logic deductions* concerning real or presumed events, and not on “faith”, “intuition”, “tastes” [2,3]. The latter are representative of the unconscious, and despite its necessity [6], it is quite impossible to control in reality its aim, information sources, and possible errors.

Quantum mechanics is a complex of paradox conclusions. One of the aims of this presentation is to search for the reasons of these conclusions. A paradox is not only the presence of some incomprehensible, in scientific research this appears often, a paradox is a contradiction revealed by logic analysis. Accordingly, the reason for these contradictions should be traced along the whole chain of theoretical deductions: those may be incorrect assumptions, errors in logic reasoning or mathematical equations.

Let us note two logic deductions concerning incomprehensible events.:

1. “Explanation” of a certain event is achieved by comparison with another event considered to be “clearly explained”, so that it becomes a model for the investigated event. This procedure is completed with an initial essential event, that at the present time requires no explanation. However, with the development of science this event could loose its essentiality and other new essential events will appear.

2. As mentioned in their philosophic papers, Berkley and Mach, the perception of incomprehensible events is restricted by our sensory organs. The accusation of Mach of “Idealism” is the quest of his opponents to establish that “reality” they *believe in*. This is not an exclusive example of “labeling”, often the ideas of the opponents are simply misrepresented. According to Mach, if an incomprehensible event is somehow revealing itself, it can be understood in the frame of possibilities of our sensory organs [7]. Using contemporary terminology, we introduce a model of the investigated event.

We are ignorant to what account our ignorance of the concrete phenomenon nature is principal. In any case, *there are no reasons to believe in any restrictions when revealing the features of an event by means accessible to our possibilities*.

An illustration could be a statement by Heisenberg, that: “quantum mechanics provides a possibility to consider atomic processes by a partly rejection of describing them in space, time and their objectification” [8].

However, in the frame of this logic, quantum mechanics is not an exception. One can study certain processes by means of constructing a physical model and

excluding those features that are not included in this model e.g. that can not be "described in time, space and their objectification". If for an event we can not find a model, this will be the case that at present *this stage* can not be sensed, or that the interpretation of this event is incorrect. Proclamation of a new "Principle" in this case does not solve the problem,

The combination of waves and particles in a light beam or in a moving particles stream properties is the most difficult to understand phenomenon of quantum mechanics.

Let us consider one of the most important problem of quantum mechanics, the wave-corpuscular dualism.

In order to estimate the often contradictory views on this problem we formulate the description of the wave and its difference from a particle as it is understood by the supporters of the dualism theory,

If we are oriented to the description in the "Physical Encyclopedia", according to which "the concept of a "wave" is so widespread and versatile that it is impossible to name an indication, …that our intuition or tradition relate to undulation"[9], then the consideration of dualism is senseless.

The conception "dualism" was formed by the notion of waves in the wave-theory of light. Acoustic waves were taken as a model of electromagnetic waves. Assuming this model to be physically real we have to believe the ether to consist of some unknown periodic disturbed elements. Einstein rejected in Special Relativity the ether, taking off by doing so the physical foundation from the wave- theory. Thereafter he practically acknowledged it, writing that in such a space the propagation of light would be impossible [10].

The difference between notions. «wave» and «particle» corresponds to the difference between a shock-wave, propagating *along an immovable* stretched wire and a moving wire-segment that can rotate and vibrate, by analogy with rotation of a particle and motion of its components.

In the «official», *first* conception to which adhered de Broglie, Planck, Bohr, Heisenberg and Born, *the dualism phenomenon was not explained, it was just fixed*, as no physical model was proposed:. "…the wave is not a physical event taking place in a certain part of space, it is more likely a symbolic representation of what we call "a particle" " [11].

Here we have an example, how to create the impression that "the problem is solved"

The problem in this case consists in the particle that according to de Broglie, should be at the same time also a wave.

It is solved here by giving a new determination of the notion "wave", calling it "a symbol".

But a "symbol" can not be characterized by a velocity or an energy, all that is assigned to the wave by the supporters of this conception.

The *second* conception entertained Schroedinger, while creating the wave equation, most important for quantum mechanics. According to that, a particle is a real wave-package built by superposition of monochromatic waves. The Furie transformation, being a mathematical abstraction, is considered as a physical reality. But a vagueness remains concerning the nature of these waves. If it is like the nature of the waves in the wave theory of light, then the particle is an ether product. But waves in ether, as mentioned earlier, are also vague, as the structure of ether remains unknown.

A negative attitude to this conception presents M. Born: a theory dealing with "a particle that has no sharply defined position being only a group of waves with indefinite boundaries, …is not and can not reach a logic completion" [12].

In fact, the cited characteristic concerning "logic completion" of a theory is relevant to Born himself, who supporting the first conception, only fixed the phenomenon without proposing a physical model for it.

"We can not understand this fact remaining in the frames of classic physics. The classic wave theory can be used only as a model describing the light events, and a model being far from sophistication.[13].

At the same time the vague moments in Schroedinger's theory mentioned by Born, are indisputable correct, but these objections are by far not sufficient.

Schroedinger refuted "quantum jumps" [14], but as mentioned earlier, the wave theory of light is based on the process of acoustic waves generation, that includes change of situation of *individual* elements with *fixed* intervals between them and corresponding *jerky changes* of these situations and intervals.

The proposed by Born "statistical interpretation of the wave-function", accepted by leading theorists in the field of quantum mechanics as a possibility to avoid difficulties, does not solve the problem. Noting the possibility of a certain event, the physical essence of this event must be known.

In fact, this interpretation substitutes continuity of structure of the wave function for a discreet structure. A statistical reduction of a sufficiently large number of realizations does not reveal the discreetness if the moment of its appearance is accidental, In this case the *mathematical presentation* of an infinite multitude of discreet structures corresponds to a continuous structure. But if a specific light beam would include a multitude of elements, averaged by registration, there would be no difference between the criticized definitions proposed by Schroedinger and their interpretation by Born. A question could arise connected with the function corresponding to the averaged action of mentioned multitudes of elements that form the particle and also with the nature of their accidence.

A dissatisfaction with his theory and its "statistical interpretation" is mentioned by Schroedinger in its Nobel presentation:

"From the point of view of wave mechanics the infinite multitude of possible trajectories of a point seems fictitious, no one of them has the privilege to be realized in any concrete case …but in a number of experiments paths of individual particles are observed. The wave theory can explain this only with huge efforts or can not provide an answer at all" [15].

The *third* conception, that has been considered by several scientists [2], reflects the idea that effects similar to those produced by waves, are connected with the quantum nature of light. Conclusions related to X-rays radiation are naturally transmitted to wave-properties of particles. However, if effects related to diffraction could be explained [16], those connected with phase displacement in interference had no explanation.

And finally, the *fourth* conception supported by A. Lande [13], refute dualism like the third does. According to this conception light is of a wave nature and features of particles interpreted as waves are explained by their quantized impulses, as justified in the paper by V. Duane [13]. What concerns the impossibility to explain interference effects mentioned above, according to Lande they can be explained by using a statistic approach.

In polemic with Lande Born reminds that photographs taken by Laue and Debye – Sherrer of electrons and X-rays having propagated through the same piece of matter, show practically no difference. This he believes is a proof that the nature of both effects is similar and corresponds with their wave-properties.

However, this similarity may be explained, like in conception three, by a manifestation of the features of particles.

What may be the reason for such a situation: a theory corresponding to the first conception, without a physical model, and therefore in-explicable, managed to occupy a leading position in contemporary quantum physics.

The main reason as we see it lies in the taken deep roots "faith" in the wave theory of light, reflected in Maxwell's electrodynamics. Certain contradictions in Maxwell's theory were artificially "removed" by Special Relativity [17,18].

De Broglie concluded, that with the discovery of the quantum nature of light "The wave theory of light …even though containing a substantial amount of truth, is not sufficient enough, and it is necessary to some extent to return to the idea of light-particles proposed by Newton" [11], So to say, the wave theory of light is not incorrect, but only "not sufficient enough". The incompatibility of quantum theory with Maxwell's electrodynamics was noted by a "believer" in the wave theory of light, Max Planck, when he considered propagation of a light quantum in space [19].

In this connection let us consider the problem that originated in the Roeserford model of the atom and that stimulated with others the development of quantum theory.

According to Maxwell's electrodynamics the rotation and acceleration of an electron around the nucleus must be accompanied by electromagnetic radiation and, corresponding, by disintegration of the atom [20].

The "way out" found by N. Bohr, corresponds to the mentioned above methodology of solving scientific problems. A postulate is introduced that in "stationary situations" no electromagnetic radiation exists. But the magnetic moment created by rotating electrons remains with accompanying action of the electric attraction force and the inertia force.

Incidentally, one of the possible conclusions is: *Maxwell's theory is incorrect*.

Before the creation of Maxwell's electrodynamics, that used propagation of acoustic waves as a model to explain propagation of electromagnetic waves, the electromagnetic events were sufficiently clear explained on base of Ampere's experiments by the Gauss – Weber electrodynamics [18,21].

According to this theory, electromagnetic energy is generated not by acceleration of an electric charge relative to ether, but by its acceleration relative to another charge interacting with it. In this case the latter is the nuclei and corresponding the potential energy is changed. This is in agreement with the determination given by Bohr of the radiation energy that is generated when an electron changes orbit [22]. Hence, rotation of an electron on a circular orbit and its interaction with the central nucleus does not generate radiation and loss of energy.

It should be noted, that in Weber's electrodynamics are excluded those problems that were mentioned by Einstein at the time of creating Relativity. Equations describing the interaction of electric charges are not changed by movements of the observer, not only by his progressive motion, but also by rotation. Even more, the value of this interaction remains unchanged:

$$F = q_1 q_2 \left[\frac{1}{r^2} - \frac{1}{c^2 r^2}\left(\frac{dr}{dt}\right)^2 + \frac{2}{c^2 r}\left(\frac{d^2 r}{dt^2}\right)\right],$$

$$P = -\frac{q_1 q_2}{r}\left[1 - \frac{1}{c^2}\left(\frac{dr}{dt}\right)^2\right],$$

where F is the interaction force of the charges q_1 and q_2 , r is the distance between these charges, P is Weber's potential.

An impression is produced that Einstein was not acquainted with Weber's electrodynamics. This follows from its reaction to the "Mach Principle", postulating induction of inertial mass by gravitation, though this is spontaneous following from earlier studies on gravitation by Zoellner, who developed the theory by Weber [18,21]. This is most striking, as those scientists worked in the same country, with a relatively small time interval between them; the scientific circle was rather small, and the number of scientific journals publishing these

papers restricted. It seems, that the role of those theories, that primary originate in the conscious of scientists, is by this means confirmed [1].

The alternate theory of electromagnetism, the theory by Gauss – Weber was actually forgotten, at least it was considered as a historical phase, though it is much nearer to the quantum theory. being based on interaction of discrete charges. It appears, that Weber himself gave way to the general frame of mind regarding Maxwell's theory. It is possible that to extend Weber's theory on the process of electromagnetic radiation, that is covered by Maxwell's theory, there were still lacking conceptions of distance interaction in the developing quantum theory. Below is given a plausible scheme of charges interaction in a description by Heisenberg:

"The quantum theory has lead to the conclusion that each field-theory is associated with elementary particles assigned to it. Their physical properties are embodied in field equations related to them. A field in this interpretation describes only the probability distribution of the related particles. So, light quanta are the kind of particles that represent the electromagnetic field. The Coulomb interaction of two electrons is generated by "virtual" light quanta originating in the position-point of one electron, propagate with light velocity and are absorbed in the point where the second electron is situated" [23].

A characteristic detail we have here: Heisenberg tries to explain how common processes can be treated on the basis of the corpuscular and the wave theory. But as the application of wave theory meets with serious difficulties, that are specified in the mentioned above remarks of supporters and several authors of the "official" conception, such as Plank de Broglie, Born, than why hold on to this theory? Specifically, if deny the wave theory of light, e. g. treat radiation of light only as a stream of particles, no matter what their compactness, then the problem of "dualism" and all the paradoxes linked to it disappear.

Yet, if two models, Maxwell's electrodynamics complying with the wave theory, and Weber's electrodynamics in specific cases arrive to the same result that does no mean that they are interchangeable in other cases. Decisive is the choice of the version that better corresponds to reality.

We have already shown, that Maxwell's theory oriented on action of the immovable ether, leads, contrary to Weber's theory, to an incorrect interpretation of the force acting on a rotating electron. Without artificial definitions of Special Relativity that can not change anything, it violates the independence of the results from the movements of the observer.

Application of Weber's equation to gravitational charges allowed ahead-derivation of Mach's postulate ("Mach's principle" according to Einstein), concerning the induce of inertial mass by an accelerated gravitational field.

We have shown that the famous formula $E = mc^2$, that in the *general case* was *postulated* by Einstein, while its derivation in Relativity is linked to Maxwell's electrodynamics [17,18], follows from Weber's equation [18,21]. Besides, an analysis shows that even if this formula is used in

computations in atomic physic on a level with the law of energy conservation, it is not always abided.

That Weber's theory is associated with the corpuscular theory of light in quantum theory testify (as is shown in our publications} the fact that Weber's equation, describing the force between moving charges on base of an analysis of Ampere's experiments, is *derived* proceeding from Heisenberg's scheme of charges interaction as presented above, and from several natural assumptions. [21].

What is the structure of a photon like in the corpuscular theory and its connection with particles that accomplish the field action.

It is believed that these particles are light quanta — photons, or "virtual photons". But these particles perform an one-polarity action, attraction or repulsion, while a photon being originated by an oscillating process performs a periodical multi-polarity action. Taking into account that the oscillating action corresponding to the action of the photon is added up of consecutive action of particles nominated "virtual", we arrive to the conclusion that a photon consists of these particles. A photon moving in space is one "having lost contact" with charges given rise to him.

Hence, these particles are not photons. A photon is a group of these particles moving with the velocity of light.

If the discreteness factor, that is inevitable by functioning of discreet elements, is excluded and the object of light action is considered to be immovable, then the *functional* action of such a photon is equivalent to a wave package (not considering aspects, connected with the paradox uncertain form attributed to this wave formation). Simultaneous action of such photons creates an interference pattern similar to the wave theory. By analogy with it a summary power is built by simultaneous and consecutive action on the object, naturally if the superposition principle is observed.

We have not considered the problem of distribution and orientation of the particles in the space occupied by photons, which ,among other factors, should determine its polarity. Due to the motion of the electron from which back off these particles, the distance between them varies and beside progressive action they perform undulating varying transverse action on the encountered object,- the direction of the vector corresponding to the voltage of an electric field.

Hence, an interpretation of the corpuscular theory of light in quantum theory, supplementing the statistical approach is contemplated.

At the same time an element of enigma is taken off from the "virtual photon", lacking the characteristic sign of a photon,- the voltage oscillations. It is better to name them "*field particles*", as their action in a certain way is similar to the action of the, also hypothetical, continuos field. The main characteristic feature of field particles is not only their discreteness but that they have been given rise by charges and not by immobile or even .mobile ether.

The acceptance of the new particle was prevented (by our judgement) by the idea of an indivisible photon and the incompatibility of a pulled apart photon

with the dualism principle and correspondingly with the mathematical description of electromagnetic waves in Maxwell's theory. In this theory, contrary to its physical prototype (the acoustic waves) did not appear a wave divided into one-polarity elements, disturbing its continuity. Supporters of the wave theory, as has been mentioned earlier, accept the abstract Furie-transformation as a physical reality, even as several of them deny it.

De Broglie considers the link between "corpuscular and wavy parts of single material and radiating objects" a "mysterious constant h " in Planck's equation

$$E = \nu h$$

(E is the energy of the photon and ν — the frequency of the light wave). It should be mentioned that Planck considering E as the energy of elementary oscillators, noted that "the action quantum h is fundamentally important for non-periodic and non-stationary events"[25]. The notion "action" corresponds to the principle of least action by Euler, Lagrange, Hamilton [26]. It is possible to determine an augmentation of action of a particle corresponding to the elementary action — h:

$$\Delta S_h = mv\,\Delta q = m\,v^2 \Delta t = 2E\,\Delta t\,, \qquad (1)$$

by simultaneous change of the path and the impulse of the particle:

$$\Delta S_h = \Delta p\,\Delta q = \Delta E\,\Delta t \qquad (2)$$

(m, ν, E are in succession mass, velocity, and kinetic energy of the particle, Δq, Δt, Δp, ΔE are the augmentations of time, impulse and energy determined by accomplished work).

This expression *contains no wave elements*. Plank's equation notes only the quantization of "action". By using this equation for a particle the frequency ν and the wavelength λ , in de Broglie's equation,

$$p = \frac{h}{\lambda}$$

must have another meaning. (p is the impulse).

In the case of a photon, the restricted time of radiating and absorbing the energy of a beam reflects the value of longitudinal dimension of the photon. The dimension of a photon can be also deduced by means of a laser's impulse radiation with a impulse prolongation corresponding to several wavelengths.[27].

Rejection of the wave theory, according to which .. " to be defined needs an infinite wave array ….and the energy is concentrated in a very small particle" [28] removes the "difficulties to understand Planks equation" according to Born.

From Planck's equation follows that *the energy of a photon* E_f *is not depending on the number of waves*. Let us assume, on base of the simplest mechanical action of an electric oscillations current, that *the prolongation of the action of a photon is the minimal possible value* for the current not to transfer the charge, e. g.

one full period of oscillation action — T_f. In this case Planck's equation can be expressed as follows:

$$E_f = \frac{h}{T_f} \quad . \tag{3}$$

In accordance with assumptions made, the wavelength in the wave theory equals the length of the photon, — L_t and de Broglie's equation will be:

$$p_f = \frac{h}{L_f}, \tag{4}$$

here p_f is the impulse of the photon.

For other particles equations (3) and (4) will be:

$$E_n = \frac{h}{T_n} \ , \tag{5}$$

$$p_n = \frac{h}{L_n} \tag{6}$$

(E_n , p_n . T_n. and L_n , are successfully: discrete quanta of their energy and impulse action, prolongation and value of the particles path during its action).

L_n can be regarded conventionally as the size of the particle.

As in the case of a photon, it can not be excluded that inside the particle oscillations or rotational processes take place.

In the context with all presented above a doubt arises if it is expedient to identify definitions "quantum" and "wave" when applied to the denomination of mechanics, the main aim of which is the study of motion and interaction of bodies in the micro-world. The utilization of such a twofold denomination leads to the conclusion that quantization is without fail linked with the wave theory. Certain authors not supporting the official point of view state, that wave theory is used only for description, but, as shown in this presentation, an unsuccessful model is depicted as being real and hampers the search for the true solution.

At the same time, there exists a substantial difference between quantum mechanics and the classical mechanics without application of the wave theory, particularly just *in relation to the existence of quantization of energy and action*. The important role of the notion "action" is also quite a difference.

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