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Electrical Impulse of Nuclear and Other Explosions

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Abstract

Fifty years since Americans past already more than exploded in space above Pacific Ocean H-bomb and revealed in this case new physical phenomenon. It consists in the fact that the explosion is accompanied by the electric pulse of very large amplitude and short duration. But up to now, in spite of all efforts of physicists, was not created the theory, which could explain this phenomenon. For the author of present article it was possible to solve this problem. The concept, which gives the possibility to explain the phenomenon of the electric pulse of nuclear explosion, is assumed the dependence of the scalar potential of charge on its speed. This approach explains not only the appearance of electric pulse with the nuclear explosions, but also a number of other physical phenomena, which earlier in the electrodynamics explanations did not have.

1. Introduction



Fig. 1. Map of tests according to the program Starfish.

According to the program *Starfish* USA exploded in space above Pacific Ocean Hbomb. Explosion was produced at the height of 400 km, it TNT equivalent was 1.4 Mt. This event placed before the scientific community many questions. In 1957 future Nobel laureate doctor Hans Albrecht Bethe gave the forecast of the consequences of such explosion. It predicted that with this explosion on the earth's surface will be observed the electromagnetic pulse (EMP) with the tension electrical fields not more than 100 V/m. But with the explosion of bomb discomfiture occurred, fields on the tension of electrical, beginning from the epicentre of explosion, and further for the elongation of more than 1000 km of it reached several ten thousand volt per meters. Actual chart area and value of tensions fields on given in Fig. 1

the height of 290 km was exploded H-bomb with the TNT equivalent 0.3 Mt. Actual chart area with the indication of the values of tensions pour on, obtained with this explosion, it is shown in Fig. 2 comparing data with respect to the tensions pour on, given on these two maps, it is possible to see that the values of tensions pour on in Fig. 1 diminish with an increase in the distance from the epicentre of explosion, while on the map, depicted in Fig. 2, these values grow. From this it is possible to draw the conclusion that on the second map are cited the data on the measurement by the horizontal intensity of electrical fields on.

IN the USSR for Program K not far from Dzhezkazgan at



Fig. 3. Experimental dependence of amplitude EMP on the time, obtained with the tests according to the program Starfish.

To Fig.3 is given the graph of EMP, recorded at a distance 1300 km from the epicentre of explosion, obtained with the tests according to the program *Starfish*. It is evident from the given figure that EMP has not only very large amplitude, but also very short duration.

Since of doctor Bethe forecast did not justify, it was subsequently advanced a number of the theories, intended to explain experimental data. The first of them was developed by doctor Conrad Longmire in 1963, which examined a question about the formation of the magnetic dipole, formed by the Compton electrons, which revolve around the lines of force of earth's magnetic field. However, this model cannot explain so short a pulse duration.

In 1975, Louis W. Seiler, Jr has developed a model in which it is assumed that the EMP generated by relativistic Compton electrons, which the rigid X-radiation knocks out from the molecules of air and which cophasal with gammaradiation move with the relativistic speeds in the direction of propagation of electromagnetic wave. Such electrons simultaneously with gamma-radiation move with the relativistic speeds in the direction of propagation of electromagnetic wave. Neither one nor the other model is reliably accepted or disproved be it cannot, since further nuclear tests in space were ended, and there is no additional experimental data, which could confirm or refute the models examined. It should be noted that neither one nor the other model up to now is published in the scientific journals. It assumes this model that the process of the pulse shaping is not the property of explosion itself, but is the second effect, connected X-radiation it with the fact that knocks out from the molecules of air Compton electrons. It follows that the pulse is extended from the ionosphere into the lower layers of the atmosphere, and its field higher than ionosphere, directly in space itself, they be absent from it. But, if we with the aid of the theories examined even somehow possible explain the presence of electrical field on in the visibility range of explosion, then the fact of strong ionospheric disturbances at large distances from the explosion, which it accompanied, to explain difficultly. Thus, after explosion in the course of several ten minutes there is no radio communication with Japan and Australia, and even at a distance into 3200 km from the epicentre of explosion were fixed ionospheric disturbances, which several times exceeded those, which are caused by the most powerful solar flares. These disturbances in their intensity several orders exceeded the disturbances, caused by the most powerful solar flares. Explosion influenced also the automatic spacecraft. Three satellites were immediately disabled. The charged particles, which were appeared as a result explosion, were seized by the magnetosphere of the Earth, as a result of which their concentration in the artificial Earth radiation belt it increased by 2-3 orders. The action of radiation belts led to the very rapid degradation of solar batteries and electronics in seven more satellites, including in the first commercial telecommunication earth satellite Telestar-1. On the whole explosion derived from

system third of the earth satellite which were being found in low orbits at the moment of explosion.

With the explosion of nuclear charge according to the program *Program K*, which was realized into the USSR, the radio communication and the radar installations were also blocked at a distance to 1000 km. As a result these tests it was established that the high-altitude nuclear explosions are accompanied by the emission of the powerful pulse, which considerably exceeds in the amplitude the value of the pulse, which occurs with the surface explosions of the same power. It was discovered, that the registration of the consequences of space nuclear explosion was possible at the large to 10 thousand kilometers distances from the point of impact.

From the point of view of the existing concepts of classical electrodynamics Compton models cause serious questions. For example, why all Compton electrons must move cophasal with the front of gamma-radiation with the relativistic speed. In Compton electrons the velocity vector has spatial distribution, in connection with this it is not possible to obtain such short of the pulse rise, as it takes place in actuality. In the electrodynamics such mechanisms, which give the possibility to obtain the single-pole pulse of electric field without the three-dimensional separation of charges in this place theoretically be absent. But in the pulse rise time, which is calculated by tens of nanoseconds, it is not possible to obtain this short pulse.

Consequently, the everything indicates that within the framework existing classical electrodynamics the results, obtained with the tests according to the program *Starfish* and *Program K*, cannot be explained thus far.

In what does consist the danger of the forecasts, which does give the model of Compton electrons? Problem in the fact that this model excludes the possibility of the presence pour on pulse in space. Let us assume that model Louis W. Seiler, *Jr.* is incorrect. Let us assume that model advanced Louis W. Seiler, Jr. is incorrect, and, relying on it as in the past for the predictions of Hans Albrecht Bethe, will be produced the sequential explosion of nuclear charge in space, which will put out of action a large quantity of satellites. Moreover this explosion can be both the planned and realized for terrorist purposes. Then be justified already is late.

In order to understand, why up to now in the scientific journals there are no publications on the matter under discussion, and why, until now is absent the universally recognized scientifically substantiated theory of the phenomena indicated, let us examine the state of contemporary classical electrodynamics, and also those prerequisites, which can help the solution of the problems indicated.

The data, given in the introduction, be absent from the scientific articles and the monographs for that reason, that the publications on this theme in the sources indicated be absent, but they are located in the Internet.

2. Concept of Scalar-Vector Potential

2.1. Introduction

Laws of the classical electrodynamics they reflect experimental facts they are phenomenological. Unfortunately, contemporary classical electrodynamics is not deprived of the contradictions, which did not up to now obtain their explanation.

The fundamental equations of contemporary classical electrodynamics are Maksvell equations. They are written as follows for the vacuum [1]

$$rot \ \vec{E} = -\frac{\partial B}{\partial t} \ , \qquad (2.1.1)$$

$$rot \ \vec{H} = \frac{\partial \vec{D}}{\partial t}, \qquad (2.1.2)$$

$$div \ \vec{D} = 0$$
, (2.1.3)

$$div \ \vec{B} = 0$$
, (2.1.4)

where \vec{E} and \vec{H} is tension of electrical and magnetic field, $\vec{D} = \varepsilon_0 \vec{E}$ and $\vec{B} = \mu_0 \vec{H}$ is electrical and magnetic induction, μ_0 and ε_0 is magnetic and dielectric constant of vacuum. From these equations follow wave equations for the electrical and magnetic field

$$\nabla^2 \vec{E} = \mu_0 \varepsilon_0 \frac{\partial^2 \vec{E}}{\partial t^2}, \qquad (2.1.5)$$

$$\nabla^2 \vec{H} = \mu_0 \varepsilon_0 \frac{\partial^2 \vec{H}}{\partial t^2}, \qquad (2.1.6)$$

These equations show that in the vacuum can be extended the plane electromagnetic waves, the velocity of propagation of which is equal to the speed of light

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}.$$
 (2.1.7)

For the material media Maxwell equations they take the following form

$$rot \ \vec{E} = -\mu \mu_0 \frac{\partial \vec{H}}{\partial t} = -\frac{\partial \vec{B}}{\partial t}, \qquad (2.1.8)$$

$$rot \ \vec{H} = ne\vec{v} + \varepsilon\varepsilon_0 \frac{\partial \vec{E}}{\partial t} = ne\vec{v} + \frac{\partial \vec{D}}{\partial t}, \qquad (2.1.9)$$

$$div D = ne$$
, (2.1.10)

$$div \ \vec{B} = 0$$
, (2.1.11)

where μ and ε is the relative magnetic and dielectric

constants of the medium and of *n*, *e* and \vec{v} is density, value and charge rate.

Of equations (2.1.1 - 2.1.11) are written in the assigned inertial reference system (IRS), and in them there are no rules of passage of one IRS to another. Consequently, if are recorded wave equation in one IRS, then it is not known how to write down them in another frame of reference, which moves relative to the first system. The given equations also assume that the properties of charge do not depend on their speed, since in first term of the right side of equation (2.1.9) as the charge its static value is taken. These equations also assume that the current can leak both in the electrically neutral medium and to represent the isolated flow of the charged particles. These both situations are considered equivalent.

In Maksvell equations are not contained indication that is the reason for power interaction of the current carrying systems; therefore to be introduced the experimental postulate about the force, which acts on the moving charge in the magnetic field. This postulate assumes that on the charge, which moves in the magnetic field, acts the force [2]

$$\vec{F}_L = e \left[\vec{v} \times \mu_0 \vec{H} \right]. \tag{2.1.12}$$

However in this axiomatics is an essential deficiency. If force acts on the moving charge, then must be known the object, from side of which acts this force. In this case the magnetic field is independent substance, comes out in the role of the mediator between the moving charges. Consequently, there is no law of direct action, which would give answer to a question, as interact the charges, which accomplish relative motion.

Equation (2.1.12) causes bewilderment. In the mechanics the forces, which act on the moving body, are connected with its acceleration, with the uniform motion there exist frictional forces. The direction of these forces coincides with the velocity vector. But the force, determined by Eq. (2.1. 12), have completely different property. Rectilinear motion causes the force, which is normal to the direction motion, what is assumed none of the existing laws of mechanics. Therefore is possible to assume that this some new law, which is concerned relative motion of those only of charged tel.

Is certain, magnetic field is one of the important concepts of contemporary electrodynamics. Its concept consists in the fact that around any moving charge appears the magnetic field (Ampere law), whose circulation is determined by the equation [2]

$$\oint \vec{H}d\vec{l} = I , \qquad (2.1.13)$$

where I is conduction current. If we to the conduction current add bias current, then we will obtain the second equation of Maxwell (2.1.9).

It should be noted that the introduction of the concept of magnetic field does not be founded upon any physical basis, but it is the statement of the collection of some experimental facts, which with the aid of the specific mathematical procedures in large quantities of the cases give the possibility to obtain correct answer with the solution of practical problems. But there is a number of the physical questions, to which the concept of magnetic field answer does not give. Using Eqs. (2.1.12) and (2.1.13) not difficult to show that with the unidirectional parallel motion of two like charges, or flows of charges, between them must appear the additional attraction. However, if we pass into the inertial system, which moves together with the charges, then there magnetic field is absent, and there is no additional attraction. This paradox in the electrodynamics does not have an explanation. It does not have an explanation, also, in the special theory of relativity (STR).

With power interaction of conductors, along which flows the current, forces are applied not only to the moving charges, but to the lattice. But the concept of magnetic field also to this question answer does not give, since. In Eqs. (2.1.1-2.1.13) the presence of lattice is not considered. At the same time, with the flow of the current through the plasma its compression (pinch effect), occurs, in this case forces of compression act not only on the moving electrons, but also on the positively charged ions. And, again, the concept of magnetic field cannot explain this fact, since in this concept there are no forces, which can act on the ions of plasma.

As the fundamental law of induction in the electrodynamics is considered Faraday law, consequence of which is the first Maksvell equation. However, here are problems. It is considered Until now that the unipolar generator is an exception to the rule of flow. The existing state of affairs and those contradictions, which with this are connected, perhaps, are most are clearly formulated in the sixth volume of work [2]. We read on page 52 we read "..." flow rule", according to which electromotive force in the outline it is equal to the speed undertaken with the opposite sign, with which changes magnetic flux through the outline, when flow changes due to field change or when outline moves (or when it occurs and that and, etc). Two of the possibility of - "the outline of moves" or "the field of changes" - are not distinguished of into of tu the formulation of the rule . Nevertheless, for explaining the rule in these two cases we used two completely different laws: $\begin{bmatrix} \vec{v} \times \vec{B} \end{bmatrix}$ for

"moving outline" and $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ for "changing field".

"We know in physics not of one such example, if simple and precise general law required for its present understanding of analysis in the terms of two different phenomena. Usually of so beautiful of the generalization of proves to be of outgoing from of the united of the deep of that being basic of the principle of. But in this case of any separately deep principle it is not evident".

All these examples be evidence the fact that the law of the induction of Faraday is inaccurate or not complete and does not reflect all possible versions of the appearance of electrical fields on with a change of the magnetic field or during the motion in the Ger.

From the aforesaid it is possible to conclude that physical nature of Lorentz force, which from the times of Lorenz and Poincare is introduced by axiomatic method, is not thus far known to us.

2.2. Laws of the Induction

With conducting of experiments established that in the outline is induced the current, when in the adjacent outline direct current is switched on or is turned off or adjacent outline with the direct current moves relative to the first outline. Therefore in general form Faraday law is written as follows [3]

$$\oint \vec{E}' d\vec{l}' = -\frac{d\Phi_B}{dt} \ . \tag{2.2.1}$$

This writing of law indicates that with the determination of the circulation of \vec{E} in the moving coordinate system, near \vec{E} and $d\vec{l}$ must stand primes and should be taken total derivative. But if circulation is determined in the fixed coordinate system, then primes near \vec{E} and $d\vec{l}$ be absent, but in this case to the right in Eq. (2.2.1) must stand particular time derivative.

Complete time derivative in Eq. (2.2.1) indicates the independence of the eventual result of appearance electromotive force (emf) in the outline from the method of changing the flow. Flow can change as because \vec{B} it depends on time, so also because the system, in which is determined the circulation $\oint \vec{E'dl'}$, it moves in the magnetic field, whose value depends on coordinates. The value of magnetic flux in Eq. (2.2.1) is determined from the equation

$$\Phi_{B} = \int \vec{B} \, d\vec{s}' \tag{2.2.2}$$

where the magnetic induction $\vec{B} = \mu \vec{H}$ is determined in the fixed coordinate system, and the element $d\vec{s}'$ is determined in the moving system. Taking into account Eq. (2.2.1), we obtain from Eq. (2.2.2)

$$\oint \vec{E}' d\vec{l}' = -\frac{d}{dt} \int \vec{B} \ d\vec{s}' \, .$$

since $\frac{d}{dt} = \frac{\partial}{\partial t} + \vec{v} \text{ grad}$ let us write down [4,5,6,7,8,9]

$$\oint \vec{E}' d\vec{l}' = -\int \frac{\partial \vec{B}}{\partial t} d\vec{s}' - \int \left[\vec{B} \times \vec{v} \right] d\vec{l}' - \int \vec{v} \, div \vec{B} \, d\vec{s}' \,. \quad (2.2.3)$$

In this case contour integral is taken on the outline $d\vec{l}'$, which covers the area $d\vec{s}'$. Let us immediately note that entire following presentation will be conducted under the assumption the validity of the Galileo conversions, i.e., $d\vec{l}' = dl$ and $d\vec{s}' = d\vec{s}$. During the motion in the magnetostatic field is fulfilled the

$$\vec{E}' = \left[\vec{v} \times \vec{B}\right].$$

Let us note that this equation is obtained not by the introduction of postulate about the Lorentz force. Thus, Lorentz force is the direct consequence of the law of magnetoelectric induction.

Faraday law indicates that how a change in the magnetic pour on, or motion in these fields, it leads to the appearance of electrical pour on; therefore it should be called the law of magnetoelectric induction. However, in the classical electrodynamics there is no law of electromagnetic induction, which would show, how a change in the electrical pour on, or motion in them, it leads to the appearance of magnetic pour on. The development of classical electrodynamics followed along another way. Was first known the Ampere law

$$\oint \vec{H} \ d \ \vec{l} = I \tag{2.2.4}$$

where I is current, which crosses the area, included by the outline of integration. In the differential form Eq. (2.2.4) takes the form

$$rot \ \vec{H} = \vec{j}_{\sigma} \tag{2.2.5}$$

where \vec{j}_{σ} is current density of conductivity.

Maxwell supplemented Eq. (2.2.5) with bias current

$$rot \ \vec{H} = \vec{j}_{\sigma} + \frac{\partial D}{\partial t} \ . \tag{2.2.6}$$

However, must exist the law of electromagnetic induction, which determines magnetic fields in the changing electric field

$$\oint \vec{H}' d \, \vec{l}' = \frac{d \, \Phi_D}{d \, t} \tag{2.2.7}$$

where $\Phi_D = \int \vec{D} \, d \, S'$ is the flow of electrical induction [4,5,6,7,8,9]

$$\oint \vec{H}' d \vec{l}' = \int \frac{\partial \vec{D}}{\partial t} d \vec{S} + \oint [\vec{D} \times \vec{V}] d \vec{l}' + \int \vec{V} div \vec{D} d \vec{S}' . \quad (2.2.8)$$

In contrast to the magnetic pour on, when $div \vec{B} = 0$, for the electrical field on $div \vec{D} = \rho$ and last term in the right side of Eq. (2.2.8) it gives the conduction current of I and from Eq. (2.2.7) the Ampere law immediately follows. During the motion in the DC fields we obtain

$$\vec{H} = [\vec{D} \times \vec{V}] \tag{2.2.9}$$

As shown in the work [2], from Eq. (2.2.9) follows and Bio-Savart law, if for enumerating the magnetic pour on to take the electric fields of the moving charges. In this case the last member of the right side of Eq. (2.2.8) can be simply omitted, and the laws of induction acquire the completely symmetrical form [4,5,6,7,8,9]

$$\begin{split} \oint \vec{E}'dl' &= -\int \frac{\partial \vec{B}}{\partial t} d\vec{s} + \oint \left[\vec{v} \times \vec{B} \right] dl' \\ \oint \vec{H}'dl' &= \int \frac{\partial \vec{D}}{\partial t} d\vec{s} - \oint \left[\vec{v} \times \vec{D} \right] dl' \end{split}$$
(2.2.10)

For the constants fields on transformation laws they take the following form

$$E' = [\vec{v} \times \vec{B}],$$

$$H' = -[\vec{v} \times \vec{D}].$$
(2.2.11)

2.3. Dynamic Potentials and the Field of the Moving Charges

In the classical electrodynamics be absent the rule of the conversion of electrical and magnetic fields on upon transfer of one inertial system to another. This deficiency removes STR. With the entire mathematical validity of this approach the physical essence of such conversions up to now remains unexplained.

Let us explain, what potentials and fields can generate the moving charges. The first step, demonstrated in the works [4,5,6,7,8,9] was made in this direction a way of the introduction of the symmetrical laws of magnetoelectric and electromagnetic induction.

Equations (2.2.10, 2.2.11) attest to the fact that in the case of relative motion of frame of references, between the fields \vec{E} and \vec{H} there is a cross coupling, i.e., motion in the fields \vec{H} leads to the appearance fields \vec{E} and vice versa. From these equations escape the additional consequences, which were for the first time examined in the work [4]. The electric field

$$E = \frac{g}{2\pi\varepsilon r}$$

The electric field outside a long charged rod decreases according to $\frac{1}{r}$.

If we in parallel to the axis of rod in the field of begin to move with the speed Δv another IRS, then in it will appear the additional magnetic field. If we now with respect to already moving IRS, begin to move third frame of reference with the speed Δv , then already due to the motion in the field ΔH will appear additive to the electric field $\Delta E = \mu \varepsilon E (\Delta v)^2$. This process can be continued and further, as a result of which can be obtained the number, which gives the value of the electric field of $E'_{\nu}(r)$ in moving IRS with reaching of the speed of $v = n\Delta v$, when $\Delta v \rightarrow 0$, and $n \rightarrow \infty$. In the final analysis in moving IRS the value of dynamic electric field will prove to be more than in the initial and to be determined by the equation

$$E'(r, v_{\perp}) = \frac{gch\frac{v_{\perp}}{c}}{2\pi\varepsilon r} = Ech\frac{v_{\perp}}{c}$$
(2.3.1)

If speech goes about the electric field of the single charge, then its electric field will be determined by the equation

$$E'(r,v_{\perp}) = \frac{ech\frac{v_{\perp}}{c}}{4\pi\varepsilon r^2} ,$$

where v_{\perp} is normal component of charge rate to the vector, which connects the moving charge and observation point.

Expression for the scalar potential, created by the moving charge, for this case will be written down as follows [4,5,6,7,8,9]

$$\varphi'(r, v_{\perp}) = \frac{ech \frac{v_{\perp}}{c}}{4\pi\varepsilon r} = \varphi(r)ch \frac{v_{\perp}}{c}$$
(2.3.2)

where $\varphi(r)$ is scalar potential of fixed charge. The potential $\varphi'(r, v_{\perp})$ can be named scalar-vector, since it depends not only on the absolute value of charge, but also on speed and direction of its motion with respect to the observation point. Maximum value this potential has in the direction normal to the motion of charge itself.

During the motion in the magnetic field, using the already examined method, we obtain

$$H'(v_{\perp}) = Hch \frac{v_{\perp}}{c}.$$

where v_{\perp} is speed normal to the direction of the magnetic field.

If we apply the obtained results to the electromagnetic wave and to designate components pour on parallel speeds IRS as E_{\uparrow} , H_{\uparrow} and E_{\perp} , H_{\perp} as components normal to it, then conversions pour on they will be written down

$$\begin{split} \vec{E}_{\uparrow}' &= \vec{E}_{\uparrow}, \\ \vec{E}_{\perp}' &= \vec{E}_{\perp} ch \frac{v}{c} + \frac{Z_0}{v} \Big[\vec{v} \times \vec{H}_{\perp} \Big] sh \frac{v}{c}, \\ \vec{H}_{\uparrow}' &= \vec{H}_{\uparrow}, \\ \vec{H}_{\perp}' &= \vec{H}_{\perp} ch \frac{v}{c} - \frac{1}{vZ_0} \Big[\vec{v} \times \vec{E}_{\perp} \Big] sh \frac{v}{c}, \end{split}$$

$$(2.3.3)$$

where $Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}}$ is impedance of free space, $c = \sqrt{\frac{1}{\mu_0 \varepsilon_0}}$ is

speed of light.

Conversions fields (2.3.3) they were for the first time obtained in the work [4].

3. Problem of Electromagnetic Pulse in the Concept of the Scalar-Vector Potential

It is known that problem EMP together with my students

attempted to solve academician I. B. Zeldovich [10]. However, in the scientific literature there is no information about the fact that this problem was solved by it. And only in 2013 in the periodical Engineering physics appeared the first publication, in which was given an attempt at the explanation of the phenomenon [11]. In the paper it is shown that as a result nuclear explosion appears not the electromagnetic, but electric pulse, the vector of electric field of which is directed toward the point of impact. For explaining physical nature of electric pulse are used the concept of scalar-vector potential, the assuming dependence of the scalar potential of charge on its relative speed.

In the introduction in Fig. 2 solid line showed the dependence of the pulse amplitude on the time, recorded on the oscilloscope face, obtained with the tests according to the program *Starfish*, and dotted line showed the shape of pulse, corrected taking into account the parameters of the input circuits of oscillograph.

With the detonation the products of explosion heat to the high temperature, and then occurs their gradual cooling, during which the explosive energy returns to environment. The dependence of the pulse amplitude on the time repeats the process indicated, and possible to assume that precisely the temperature of plasma determines its amplitude. In the time of the detonation of the charge of ~ 25 ns is a sharp increase in the pulse amplitude, and then there is a slower process, with which in the time of ~ 150 ns the amplitude decreases two. We will consider that the sum of these times represents the time, for which it occurs the emission of a basic quantity of energy, obtained with the explosion.

If we consider that one ton of trotyl is equivalent 4.6×109 J, then with the explosion of bomb with the TNT equivalent 1,4 Mt are separated 6.44 ×1015 J. Consequently explosive force in the time interval indicated will compose ~ 3.7×1022 W. For the comparison let us point out that the power of the radiation of the Sun ~ of 3.9×10.26 W.

Let us examine a question, where how, in so short a time, can be the intake, isolated with this explosion. With the explosion in the atmosphere the energy is expended on the emission and on the creation of shock wave. In space shock wave is absent; therefore explosive energy is expended on the electromagnetic radiation.

In accordance with Stephan-Boltzmann equation the power, radiated by the heated surface, is proportional to the fourth degree of its temperature

$$P = \sigma ST^4$$

where σ is Stephan-Boltzmann constant, and S is area of radiating surface.

In order to calculate temperature with the known radiated power it is necessary to know the surface of radiating surface. As this surface let us select sphere with the surface of $\sim 3 \text{ m2}$. Knowing explosive force and size of radiating surface, we find the temperature of the cloud of the explosion

$$T = \sqrt[4]{\frac{P}{\sigma S}} \ .$$

With the explosive force of ~ 3.7×1022 W we obtain the value of temperature equal to ~ 8.6×106 K.

In the concept of scalar-vector potential, the scalar potential of charge of g it is determined from the relationship

$$\varphi(r) = \frac{g \ ch \frac{v_{\perp}}{c}}{4\pi \ \varepsilon_0 r} \tag{4.1}$$

where, r is the distance between the charge and the observation point, v_{\perp} is the component of the charge, normal to the vector \vec{r} , ε_0 is dielectric constant of vacuum.

According to the estimations at the initial moment of thermonuclear explosion the temperature of plasmoid can reach several hundred million degrees. At such temperatures the electron gas is no longer degenerate and is subordinated to of the Boltzmann distribution. The most probable electron velocity in this case is determined by the relationship

$$v = \sqrt{\frac{2k_{\scriptscriptstyle B}T}{m}} , \qquad (4.2)$$

where T is temperature of plasma, $k_{\rm E}$ is Boltzmann constant, m is the mass of electron.

Using Eqs. (4.1) and (4.2), and taking into account with the expansion in the series of hyperbolic cosine the terms $\sim v^2$

 $\frac{v^2}{c^2}$, we obtain the value of increase in the scalar potential at

the observation point

$$\Delta \varphi \cong \frac{Nek_{\rm B}T}{4\pi\varepsilon_{\rm o} rmc^2} , \qquad (4.3)$$

where N is quantity of electrons in the cloud of explosion, e is electron charge. We determine from the formula the tension of radial electric field, which corresponds to this increase in the potential

$$E = \frac{Nek_{\rm B}T}{4\pi\varepsilon_0 r^2 mc^2} = \frac{\Delta q}{4\pi\varepsilon_0 r^2}$$
(4.4)

where

$$\Delta q = \frac{Nek_{\rm B}T}{mc^2} \tag{4.5}$$

is an equivalent charge of explosion.

One should say that with the warming-up of plasma the ions also acquire additional speed, however, since their mass considerably more than the mass of electrons, increase in their charges can be disregarded.

For enumerating the quantity of electrons it is necessary to know a quantity of atoms, which with the warming-up

formed the cloud of explosion. Let us assume that the total weight of bomb and launch vehicle, made from metal with the average density of the atoms ~ 5×1022 1/sm3, is 1000 kg. General of a quantity of free electrons in the formed plasma, on the assumption that all atoms will be singly ionized with the specific weight of the metal ~ 8 g/cm3, will comprise ~ 5×1027 .

In accordance with Eq. (4.4) the tension of radial electric field at a temperature of the cloud of the explosion $\sim 8.6 \times 106$ K will comprise: in the epicentre of the explosion $\sim 6.9 \times 104$ V/m, at a distance in 870 km from the epicentre $\sim 1.2 \times 104$ V/m and at a distance 1300 km from the epicentre $\sim 6 \times 103$ V/m. It is evident that in the epicentre the computed values of electrical pour on the earth's surface they are close to the experimental values. The ratio of calculated values to those measured they comprise: in the epicentre of explosion is 13.5, at a distance 870 km from this place is 4.5, at a distance 1300 km is 2.4. Certainly, are unknown neither the precise initial of the temperature of plasmoid nor mass of bomb and launch vehicle, in which it undermine nor materials, from which are prepared these elements. Correcting these data, it is possible sufficiently simply to obtain values pour on those being approaching experimental values. But calculated threedimensional dependence pour on strongly it is differed from experimental results. Let us attempt to explain the reason for such divergences.

Let us first examine the case, when charge is located above the metallic conducting plane (Fig. 4). The distribution of electrical fields on above this plane well known [2].



Fig. 4. Negative charge above the limitless conducting plane.

The horizontal component of electric field on the surface of this plane is equal to zero, and normal component is equal

$$E_{\perp} = \frac{1}{2\pi\varepsilon_0} \frac{zq}{\left(z^2 + x^2\right)^{\frac{3}{2}}}$$
(4.6)

where q is magnitude of the charge, z is distance from the charge to its epicentre, x is distance against the observation points to the epicentre.

Lower than conducting plane electric fields be absent, but this configuration pour on equivalent to the presence under the conducting plane of the positive charge of the same value and at the same distance as initial charge. The pair of such charges presents the electric dipole with the appropriate distribution of electrical pour on. This configuration pour on connected with the fact that charge, which is been located above the conducting plane, it induces in it such surface density of charges, which completely compensates horizontal and vertical component of the electric field of charge in the conducting plane and lower than it. The dependence of the area of the charge density from the coordinate of x also is well known [2]

$$\sigma(x) = \varepsilon_0 E_\perp = \frac{1}{2\pi} \frac{zq}{\left(z^2 + x^2\right)^{\frac{3}{2}}}.$$
 (4.7)

If we integrate $\sigma(x)$ with respect to the coordinate x, then we will obtain magnitude of the charge, which is been located above the conducting plane. In such a way as not to pass the electric fields of the charge of q through the conducting plane, in it must be contained a quantity of free charges, which give summary charge not less than the charge q. In this case two cases can realize. With the low charge density, which occurs in the poor conductors, it will arrive to move up to the significant distances significant quantities of charges. But in this case of charges it can and not be sufficient for the complete compensation. With the high charge density, it is possible to only insignificantly move charges in the plane. This case realizes in the metallic conductors.

If we periodically draw near and to move away charge from the plane, then in it will arise the periodic horizontal currents, which will create the compensating surface charges. The same effect will be observed, if charge at the particular point can be born and disappear. If at the assigned point above the plane charge suddenly in some time arises, then, so that the fields of charge would not penetrate through the conducting plane, in the same time on the conducting plane the compensating charges, which correspond to relationship must appear (4.7). The surface density of these charges corresponds to relationship (4.7). This means that the strength of currents, which create the compensating charges, there will be the greater, the greater charge itself and the less the time of its appearance. However, with the low charge density can realize another case. With a very rapid change in the electric field the charges will not have time to occupy the places, which correspond to the complete compensation for electrical pour on, and then the fields of external charge partially will penetrate through conductor, and compensation will be not complete. Then the fields of external charge partially penetrate through conductor, and compensation will be not complete. Specifically, this case realizes in the case of the explosion of nuclear charge in space, since between it and earth's surface is located the ionosphere, which possesses not too high a conductivity (Fig.5).

If charge will appear at the indicated in the figure point, thus it will gather under itself the existing in the ionosphere free charges of opposite sign for compensating those pour on, which it creates in it. However, if a total quantity of free positive charges in the ionosphere will be less than the value of charge itself, or their displacement is insufficient in order to fall into the necessary point at the assigned moment, then their quantity will not be sufficient for the complete compensation pour on the appearing charge and its fields will penetrate through the ionosphere. In this case the fields will penetrate through the ionosphere. In this case the penetrated fields, in view of the screening effect of the ionosphere, can be less than the field above it. In this case maximum compensation pour on it will occur in the region, situated directly under the charge. This process will make the dependence of electrical pour on from the distance by smoother, that also is observed during the experiment. Entire this picture can be described only qualitatively, because are accurately known neither thickness of the ionosphere nor degree of its ionization on the height.



Fig. 5. Negative charge above the earth's surface with the presence of the ionosphere.



Fig. 6. Negative charge above the earth's surface with the presence of the ionosphere.

The sphericity of the ionosphere also superimposes its special features on the process of the appearance of the compensating surface charges. This process is depicted in Fig. 6

The tendency of the emergent charge to gather under itself the compensating charges will lead to the longitudinal polarization of the substantial part of the ionosphere. The compensating positive charges in the ionosphere will in essence appear directly in the epicentre, where they will be in the surplus, while beyond the line-of-sight ranges in the surplus will be negative charges. And entire system the ionosphere - the earth will obtain additional dipole moment.

The model examined speaks, that nuclear explosion will lead not only to the appearance in the zone of straight visibility, but also to the global ionospheric disturbance. Certainly, electric fields in space in the environments of the explosion, where there is no screening effect of the ionosphere, have high values and present large danger to the automatic spacecraft.

In accordance with Eq. (4.4) the pulse amplitude is proportional to the temperature of plasma. Consequently, according to the graph, depicted in Fig. 2, it is possible to judge the knocking processes of nuclear charge and the subsequent cooling of the cloud of explosion. From the figure one can see that two peaks are visible in the initial section of the dependence of the amplitude of electric field. The first peak presents nuclear blast, which ignites thermonuclear charge, the second peak presents the knocking process of thermonuclear fuel. The rapid decrease, which characterizes the process of cooling cluster, further goes. It is evident that it occurs very rapidly. Naturally to assume that this is that period, when basic energy losses are connected with the radiant losses caused by the rigid X-radiation.

Thus, the presence of the pulse indicated they are the properties of explosion itself, but not second phenomenon.

Now should be made one observation apropos of term itself the electromagnetic pulse EMP, utilized in the literary sources. From this name should be excluded the word magnetic, since this process presents the propagation only of radial electrical fields on, and in this case magnetic fields be absent. It is known that the amplitude of the electric field of pulse can reach values ~ 50000 V/m. But if pulse was actually electromagnetic, then the tension of magnetic field would compose ~ 1.3×102 A/m. For obtaining this value should be the tension of electric field divided into the wave drag of free space. In this case the power, determined by the Poytning vector would be ~ 5 MW, which is commensurate with the power of small power station.

It is not difficult to calculate that energy, which with the nuclear explosion is expended on obtaining of electric pulse. The pulse duration is ~ 150 ns. If we consider that the pulse is extended with the speed of light, then its extent in the free space composes d=45 m. At a distance of R=400 km from the point of impact the tension of electric field was ~ 50000 V/m. Specific electric field energy composes

$$W = \frac{1}{2}\varepsilon_0 E^2 \,.$$

The total energy U of the electric field of pulse we obtain by the way of the multiplication of specific energy by the volume of the spherical layer of $4\pi r^2 d$

$$U = 2\pi r^2 d\varepsilon_0 E^2$$

Substituting in this formula the values indicated, we obtain energy ~ 1012 J. If we consider that with the explosion is separated energy ~ 6.4×1015 J, then energy of electric pulse composes ~ 0.016% of the general explosive energy.

It is another matter that electric fields can direct currents in the conducting environments, and these currents will generate magnetic fields, but this already second phenomenon.

Since the tension of electrical pour on near the nuclear explosion it is great it can reach the values of the breakdown tension of air (300000 V/m), with the explosions, achieved in immediate proximity from the earth's surface, this can lead to the formation of lightning, that also is observed in practice.

The concept of scalar-vector potential can serve and for explaining the cable is special effect. Actually, if in the process of the appearance of the cloud of explosion in it excess charge is formed, then this charge on the ropes must flow into the earth, and this in turn will lead to their additional warming-up.

4. Electric pulse of the Trotyl Charges

If the principle of the formation of electric pulse examined is accurate, then the usual explosions, with which is formed cold plasma, they must be accompanied by the appearance of electric pulse, although less intensive than with the nuclear explosion.

The disintegration of the molecule of trotyl with its detonation occurs according to the following diagram

$$C_7 H_5 O_6 N_3 = 2 H_2 O + 3.5 CO + 1.5 N_2$$
.

If each of the molecules, that was released during explosion will be singly ionized, then upon decay the molecule of trotyl will be isolated 7 free electrons. Consequently, with the detonation of one mole of trotyl will be isolated $7N_A = 4.2 \times 10^{24}$ of the electrons, where N_A is Avagadro number. With the explosion of trotyl the temperature of the cloud of explosion reaches 3500K. If all molecules of disintegration obtain single ionization, then the maximum strength of field of electric pulse composed

$$E = 3.7 \times 10^9 \frac{1}{r^2} \text{ V/m}$$

At a distance of 100 m of the point of impact the tension of electric field there will be the wound 3.7×105 V/m. However, with the explosion of trotyl charges is formed the cold plasma, in which the degree of ionization composes ~ 0.1%. The summary tension of electric field in this case will

comprise 370 V/m. The importance of this method consists in the fact that by studying the topology of pulse, it is possible to judge the knocking processes and subsequent relaxation of the cloud of explosion. Obviously, electric pulse must accompany the entry of projectile into different solid obstacles, since. in this case strong local warming-up to target with the formation of plasma occurs. Consequently, it is possible to draw the conclusion that in those places, where the plasma of any form is formed, must appear electric pulse.

In the scientific literature there are no communications about the appearance of electric pulse with the explosions of conventional explosives, but this can be connected with the fact that this question no one was investigated.

It is known that the electro-welding creates the strong radio reception disturbances, but these interferences very rapidly diminish with the distance. Micro-bursts it is possible to consider sparking in the poor contacts in the electrical networks, in the contact systems of electric transport means or the collectors of direct-current motors. But, since the amplitude of electric pulse rapidly diminishes with the distance, electric transport does not present special interferences for the radio reception.

The lightning also heat plasma to the high temperature and are created the radio reception disturbances. There is an opinion that very channel of lightning serves as the antenna, which radiates the radio waves over a wide range of frequencies. But so whether this? With that length, which represents the track of lightning, this antenna must have excellent characteristics and reliably emit not only in the short-wave, but also in the long-wave radio-frequency band. But this would mean that with any lightning stroke in any place of the terrestial globe in our receivers the interferences would appear. But since they second-by-second in the world beat hundreds of lightning, entire ether would be oppressed by interferences. This it does not occur for that reason, that the plasma cylinder of lightning emits not radio waves, but electric pulses from all its sections. In this case the excess charges, which arose in different sections of the channel of lightning, see their mirror reflection under the earth's surface, forming the appropriate dipoles, whose fields diminish inversely proportional to the cube of distance.

5. Conclusion

Fifty years since Americans past already more than exploded in space above Pacific Ocean H-bomb and revealed in this case new physical phenomenon. It consists in the fact that the explosion is accompanied by the electric pulse of very large amplitude and short duration. But up to now, in spite of all efforts of physicists, was not created the theory, which could explain this phenomenon. For the author of present article it was possible to solve this problem. The concept, which gives the possibility to explain the phenomenon of the electric pulse of nuclear explosion, is assumed the dependence of the scalar potential of charge on its speed. This approach explains not only the appearance of electric pulse with the nuclear explosions, but also a number of other physical phenomena, which earlier in the electrodynamics explanations did not have. Moreover, it turned out that this new law is the basis of all dynamic laws of electrodynamics.

One cannot fail to note and the circumstance that all started satellites must have a protection from the threat, connected with the possibility of defeat by electric pulse.

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