In content

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PHYSICS OF QUANTUM AND GRAVITATION
FOR STUDENTS AND SCHOOLBOYS

The simple computer design procedure of forces of quantum interaction of elementary particles and their congestions within the limits of the theory and practice of electromagnetism of 20th century are presented in this article. Simplicity and the universality of modern computing methods used here, has allowed to solve the most actual and interesting problems of physics, without resorting to the help of fantastic hypotheses, postulates, models, speculative theories and other wonderful images. It is shown that the range of distances for which interactions on the usual personal computer can be calculated, ideologically or programmatically is not limited almost. Therefore calculation of gravitation forces follows at once the detailed analysis of near interaction, saving connected together effects from gravitational to the quantum. For the first time has received an explanation the mechanism of intranuclear interactions.

The stated material is supplied not only by drawings and schedules, but also listings of programs by means of which they are received and of which the reader himself can take advantage in his independent work. All it is presented in shape, quite accessible to understanding by students and schoolboys on whom the statement of this article is tailored.

Introduction

This work is addressed to young men not incidentally. Here connection with a science and society current state is involved. The matter is that psychologists, art critics and psychiatrists are common in opinion that people can be divided into realists and autists according to their way of perception of reality. The second group looks only inside themselves and are always ready to talk about what they see, especially if it is connected with some benefit. While the interest of the people from the first group is directed to things outside themselves: they conceive the nuances of the outer world, compare them to what they knew before and act according to the situation. Both the psychic radicals are mutually complementary in the big human society. In 20th century as a result of wars and some other factors, the autists outbalanced the realists and started to implant their narrow world outlook not only in politics, but also in science. As a result both of them moved down into surrealism ditch. That was how the trend to study the Nature through strange surrealistic fantasies shaped as doctrines, postulates and other “models” appeared. Nowadays there are real "schools" of quasi physicists, that discuss their own and others’ glitches …, sorry, "models", but categorically disregard matter and its movement. As though they eat models of sandwiches for breakfast, and taste beer on the base of its model from an alehouse toilet. It is contrary to experience; after all they knew that Galley didn't throw glitches when he measured free fall acceleration, and Faraday didn’t create the currents of "models" in coils by magnets.

Physicists with philosophers have badly experienced stress from Max Planck's finding in 1900. He has analyzed dependence of frequency of electromagnetic radiation of a black body on its temperature, observed experimentally, and has processed it by methods of statistical physics. Calculations have shown that their results precisely correspond to experiment only under two conditions: if energy of elementary certificates of radiation accepts only discrete values and if each step between the next values is equal to some constant increased by frequency. Here so Planck has analytically received (has calculated) quanta in system of substance + electromagnetic radiation.

Autists too have appeared close and have applied surrealism to a problem according to which the electromagnetic field at all was not, but there were only photon flies. Here so all is simple: why the bird winnows by its wings? Air is not visible. But the birdie waves away from

photon flies. And why runner waving legs? Road does not counted. But photon flies tickle between feet at the runner, here it and twitches. Absurdity? No, it is … autism! (Add an article).

Despite the fact that autists are very sensitive and artful in revenge, we will turn still a problem to a real plane. And we will fairly solve a problem about interaction not of flies, but of an electromagnetic field with substance. The result will appear very much even achievable and convincing.

And still. If you, expensive reader, easily understand, about what here speech, but the interlocutor repeats all about his “models” so take compassion for autist – he is too the person and too demands indulgence. It oddity is his trouble, but it is final while he has not received power to re-educate you and other realists according the own fashion, or to exterminate in general. You never will guess that he has intended.

And, in general, you choose what is more interesting to you.

§ 1. Particles and spherical system of electromagnetic waves

All reasonings and calculations of this chapter are based on the following properties of elementary particles confirmed experimentally:

1. All elementary particles exist and interact with the electromagnetic field.
2. All elementary particles have characteristic frequencies of interaction $\boldsymbol{\nu}$ with the external variable electromagnetic field.
3. All elementary particles are rather steady, i.e. the time of their existence is a lot longer than the period of interaction $T = \boldsymbol{\nu}^{-1}$ with an electromagnetic field.

Let's note, that besides these properties and some others are also known, for example the electric charge, the magnetic moment, the spin, etc. Naturally, we know, that continuous electric and magnetic fields exist, and that they cause the well-known Coulomb's law of interaction. But now we do not include them in the list of actual ones, as basically we are going to study interaction of the big files of particles in which these factors are strongly averaged almost to neutrality. Therefore now we are focusing our attention only on variable fields. It is obvious, that all the rest can be investigated later, after finding out the essence of the strongest interaction through a variable electromagnetic field.

To the general data received as a result of experience, besides the listed properties of elementary particles, we should also add some known properties of the electromagnetic field as it is, which are either confirmed by direct experiments, or come out from Maxwell equations, which have such a firm experimental base, that their solutions are always proved by experiment to be true [1]. At that we cannot ignore the properties of electromagnetic waves in the inhomogeneous propagation medium. School textbooks contain the initial information about this process. Beyond this, we note that the solving confirmed by practice of such problems of diffraction, as scattering on a cylinder, on a cone (we are talking about the missile), on simply artillery shells (to correct the picture of the battlefield), on airplanes, etc., are well studied and described at this time.

So, all these problems comprise two parts in full accord with the principle of Huygens. The first part contains the problem of natural vibrations of waves around an object, and second - about the interference of the incident (highlighted) of the wave with the system of these oscillations. As a result the practice and theory of diffraction have created the problem of natural oscillations of electromagnetic waves around any objects that can interact with the electromagnetic field. The idea is that such systems exist in their own vibration is real and they can and must be investigated to identify the properties of objects, interacting with the field.

Thus, the properties of elementary particles is quite natural to be supplemented with the following properties of the electromagnetic field around them:

1. The variable electromagnetic field around each particle, at least outside of the internal, so far unknown area, exists and is described by the known formulas.

2. From the 3rd property of elementary particles and the 1st property of the electromagnetic field it follows, that each particle generates round itself an electromagnetic field of a stationary wave. These are such waves, in which the maximums of electric and magnetic components are divided spatially, and their fields are $\pi/2$ phase shifted.
3. The system of stationary waves is not preserved forever. In nature the relative movement of particles as well are broken by the acts of birth and annihilation. Such infringements of an average condition of a field can be considered as the perturbation of the average and steady system of stationary waves.

Let's underline once again, that the listed properties of particles and field are not hypotheses, not postulates and not by any means any "models", but those are real properties of material elementary particles and a material electromagnetic field, which are known to us for certain from experiments, and from the theory, based on experiments.

So, we believe it is a proved statement that around all elementary particles there is a variable electromagnetic field, which basic frequency (harmonic) $\boldsymbol{\nu}$ for all particles is known from equality $h\boldsymbol{\nu} = mc^2$. The reasoning of this statement can be based on the phenomena of interference and diffraction of particles and on the properties of any spatial inhomogeneities (in the terminology of a firm body - dislocations) to radiate and reradiate streams of electromagnetic energy. Only it is necessary to consider the properties of an electromagnetic field and the resonant character of interaction of particles with it. The same is testified by the results of the research of local streams of electromagnetic energy in dielectric wave-guides and nonlinear medium, which are presented in detail in [2, 3].

The listed properties of elementary particles and the field give us a chance to set and solve the problem of force fields exclusively within the limits of Maxwell's electrodynamic theory.

Research of objects with spherical symmetry takes a special place among all problems about diffraction and natural oscillations of round different bodies. There are three reasons for this. First, this problem has been solved by the first and is strict through the equations of mathematical physics (results are presented at [2,3]). Gustav Mi has published the decision on diffraction on spheres still in 1908 [4]. Secondly, Gustav Mi's results are checked repeatedly up and confirmed by experiment. And third, this decision is now the standard of level of efficiency and severity. Therefore it serves as a level of support and comparisons at statement and interpretation of all other similar problems.

Naturally, spherical problem is solved in spherical coordinates (r, φ, θ), presented on a Fig. 1. Here interpretation of vectors $\mathbf{V}_r$, $\mathbf{V}_\varphi$ and $\mathbf{V}_\theta$ follows directly from drawing.

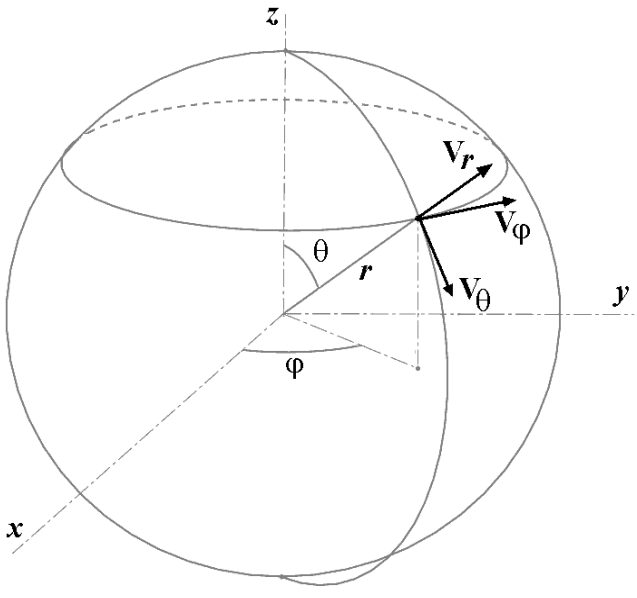

Fig. 1
Spherical system of coordinates

Spherical systems differ strongly, for example, from cubic resonators that their types of oscillations have characteristic numbers not as three integers (at a cube on *x, y, z*), but only as two – on φ and θ.

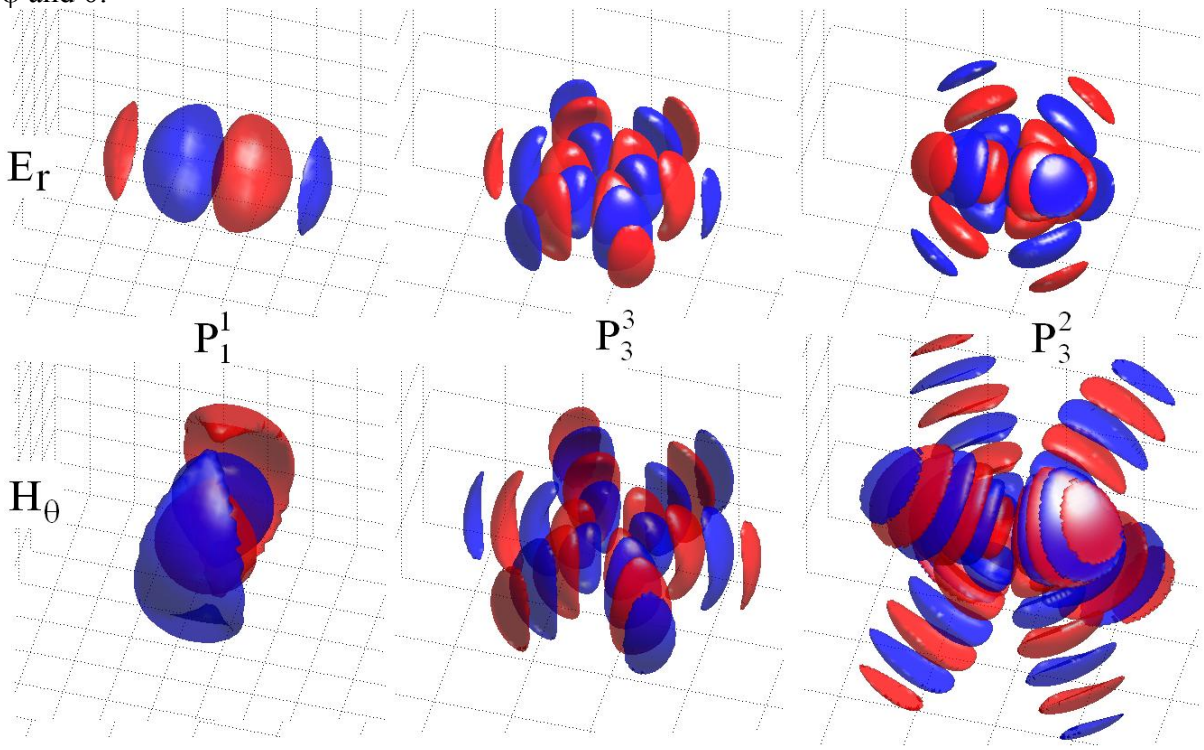

Fig. 2
Spatial distribution of fields to an example of three systems

Mathematically it is expressed through of Legendre's functions $\mathbf{P}_n^m$, which describe spherical waves (see [2,3,4]).

Spatial distribution of amplitudes of corresponding electric and magnetic fields in system of waves of E-type ($E_r \neq 0$, $H_r = 0$) is shown on a Fig.2 by means of isosurfaces (surfaces of equal amplitudes). Waves of H-type ($E_r = 0$, $H_r \neq 0$) have the same description. But to distract attention to them separately there is no necessity while in view of some symmetry. Here the spatial form of waves, which are located in the form of separate beams, is visible well. The quantity and a corner of a divergence at them depend on numbers *m* and *n*. And here the quantity of such beams can be 2 or 1000, or it is even more. But in any case they are strictly determined in space and mathematically are described with any degree of accuracy.

Further we will consider more in detail for descriptive reasons only the lowest type of fluctuations. Numbers $m=1$, $n=1$ correspond to it and, accordingly, function $P_1^1 = sin\,(\theta)$. Then, for example, amplitudes can be written down as three electric components according [2, 3, 4] (details and magnetic components see lower in program listing):

$$
\begin{aligned}
Er_1^{\,1} &= \frac{2}{(kr)^2} \cdot R_1(kr) \cdot \sin(\theta) \cdot \cos(\varphi) \\
E\theta_1^{\,1} &= \frac{1}{kr} \cdot \frac{d}{dkr} R_1(kr) \cdot \cos(\theta) \cdot \cos(\varphi) \\
E\varphi_1^{\,1} &= -\frac{1}{kr} \cdot \frac{d}{dkr} R_1(kr) \cdot \sin(\varphi),
\end{aligned}
\qquad (1)
$$

where r, θ, φ are spherical coordinates, $Er_1^{\,1}$, $E\theta_1^{\,1}$ and $E\varphi_1^{\,1}$ are the radial and the angular components of the variable electric field respectively, $R_1\,(kr)$ is radial function, k is the wave number.

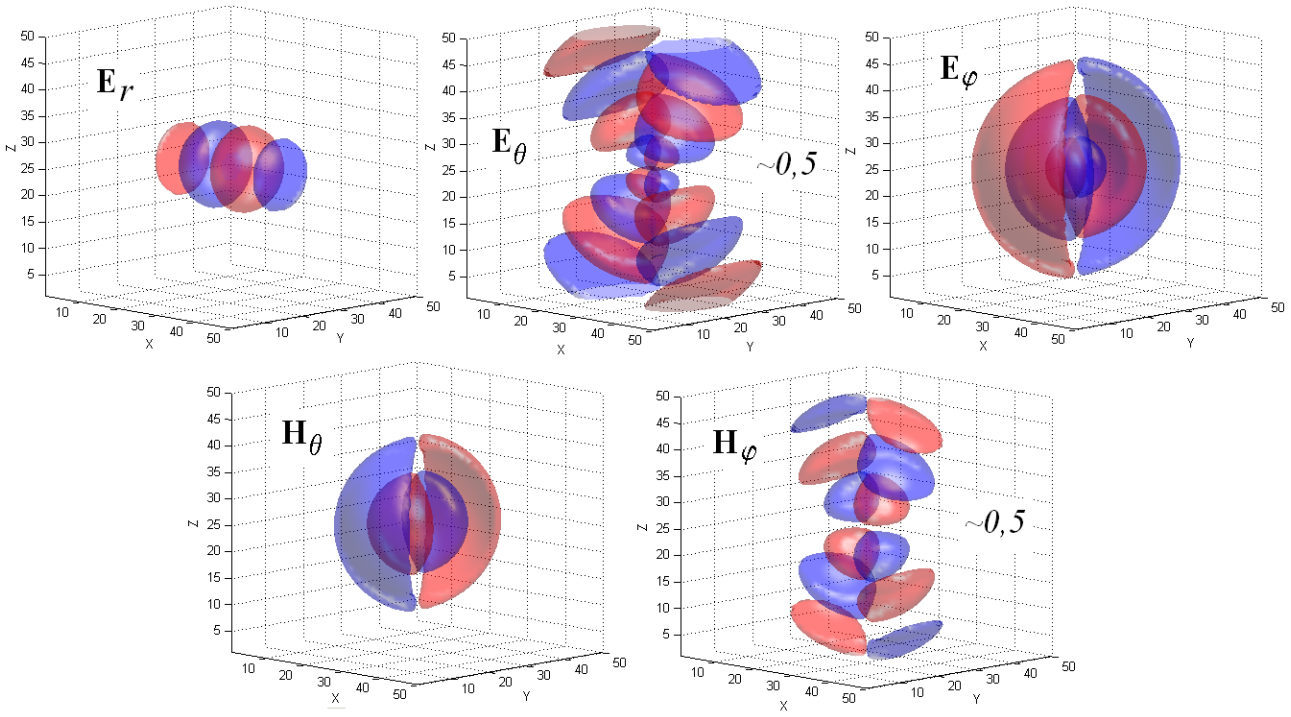

Fig. 3
Spatial distribution of components of fields **E** and **H** in system P_1^1

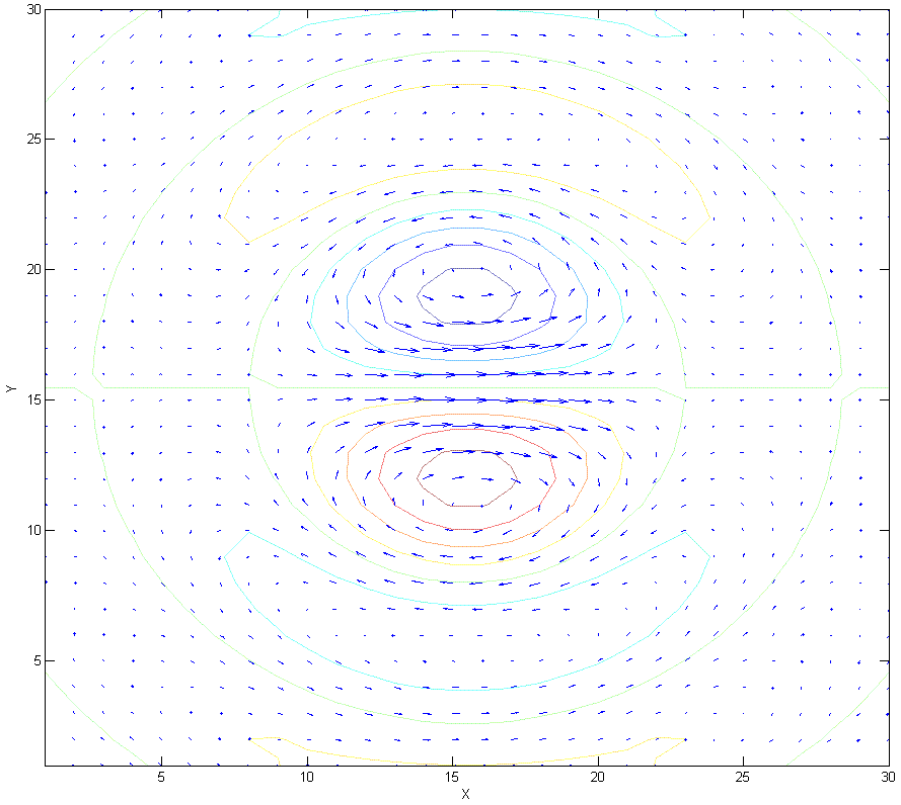

Fig.4
Vector image E_r against contours H_θ

Spatial configuration of components of electric and magnetic fields in such system are presented on a Fig.3. Here the mark ~0,5 means that E_θ and H_φ approximately are twice less than amplitudes E_φ and H_θ.

The analysis of a Fig.3 shows that electromagnetic configuration P_1^1 has two basic beams of an external field. Their maximums are located in a plane (*x, y*). Therefore it makes sense to present distribution of total vector **E** by arrows in this section, and of the amplitude of magnetic field **H,** perpendicular to it, to mark in black-and-white color as contours by means of function `contour(Hz)`. Then we will receive such evident description of a field configuration, which is presented in a Fig.4. We will notice that this picture have better kind on the computer display in color through function `pcolor(Hz)`. But the format of this article complicates the volume and color transfer.

Images in a Fig.3 and a Fig.4 are received by means of the program written for MatLab environment which text is presented lower. The calculation technique of functions `Rj_kr(n, R)` and `dRj_kr(n, R)` is in [2, 3].

```
%-------------------------------------------------------------------------------
function Z = Rj_kr(n,X)   %Radial function
M = ones(size(X));
if n==1, Z = ((2/pi)^(1/2))*( sin(X)./X - cos(X) );
elseif n==2, Z = ((2/pi)^(1/2))*( (3*(X.^(-2))-M).*sin(X) -3*cos(X)./X );
end
%-------------------------------------------------------------------------------
function Z = dRj_kr(n,X)  %Derivate of Radial function
M = ones(size(X));
if n==1, Z =((2/pi)^(1/2))*((-(X.^(-2))+ M).*sin(X) + cos(X)./X);
elseif n==2,
Z = ((2/pi)^(1/2))*((-6*(X.^(-3))+3*X.^(-1)).*sin(X) + (6*(X.^(-2))-M).*cos(X));
end
%-------------------------------------------------------------------------------
nn =1;          %The variant select
m=50; z0=376.5; n=1;  % Constants

X = cumsum(ones(n*m,m,m),1)-(m/2+0.5)*ones(n*m,m,m);
Y = cumsum(ones(n*m,m,m),2)-(m/2+0.5)*ones(n*m,m,m);
Z = cumsum(ones(n*m,m,m),3)-(m/2+0.5)*ones(n*m,m,m);
R = 0.6*(X.^2 + Y.^2 + Z.^2).^(1/2);
tet=atan2((X.^2+Y.^2).^(1/2),Z) ;   fi=atan2(X,Y) ;
clear X Y Z;

Er = 2*(Rj_kr(1,R)./(R.^2)).*sin(tet).*cos(fi);
Et = (dRj_kr(1,R)./R).*cos(tet).*cos(fi);
Ef = -(dRj_kr(1,R)./R).*sin(fi);
Ht = (1/z0)*(Rj_kr(1,R)./R).*sin(fi);
Hf = (1/z0)*(Rj_kr(1,R)./R).*cos(tet).*cos(fi);

Ex = Er.*sin(tet).*cos(fi) - Ef.*sin(fi) + Et.*cos(tet).*cos(fi);
Ey = Er.*sin(tet).*sin(fi) + Ef.*cos(fi) + Et.*cos(tet).*sin(fi);
Ez = Er.*cos(tet) - Et.*sin(tet);
Hx = - Hf.*sin(fi) + Ht.*cos(tet).*cos(fi);
Hy = Hf.*cos(fi) + Ht.*cos(tet).*sin(fi);
Hz = - Ht.*sin(tet);
clear  R fi tet;

if nn == 1
    A=1*Er; aa =0.04; %It is necessary to correct a argument end level
    We=A.*sign(sign(A)+sign(abs(A))); Wh=A.*sign(sign(A)+sign(-abs(A)));
    X = 1:n*m; Y = 1:m; Z = 1:m;
            p = patch(isosurface(X,Y,Z,We,aa)); %
    isonormals(X,Y,Z,We,p);
    set(p,'facecolor','red','edgecolor','none');
    set(gcf,'color','white');
    daspect([1 1 1]); view(45,10);  %view(3)
    xlabel('X'); ylabel('Y');zlabel('Z');
    axis([min(X) max(X) min(Y) max(Y) min(Z) max(Z)]); grid on;
```

```
    camlight; lighting gouraud; %grid off;
        p = patch(isosurface(X,Y,Z,Wh,aa));
    isonormals(X,Y,Z,Wh,p);
    set(p,'facecolor','blu','edgecolor','none');
    camlight; lighting gouraud;
    alpha(.3)
elseif nn == 2
    Ex=Ex(:,:,m/2); Ey=Ey(:,:,m/2); Hz=Hz(:,:,m/2);
    contour(Hz); %or pcolor(Hz)
    colormap((jet+white)/2); shading interp;
    hold on
    quiver(Ex,Ey);  xlabel('X'); ylabel('Y');
    set(gcf, 'color', 'white');
    hold off
end
clear Ex Ey Ez Hx Hy Hz Er Ef Et Hf Ht We Wh X Y Z A aa m n nn p z0
%-------------------------------------------------------------------------
```

The spherical electromagnetic configuration, which example it is presented on a Fig.2, a Fig.3 and the Fig.4, corresponds to a mode of a stationary wave. And, as well as should be in a radial stationary wave, E_{φ} and H_{θ} components are displaced on a phase on $\pi/2$ in a radial direction. This mode has been defined previously at problem statement. Any change of this condition will mean necessarily occurrence of a stream of energy in a corresponding direction, including from the center and to the center, or sideways, for example. However this configuration has one more feature: maximums of electric and interfaced to it magnetic component in the center are dislodged on a phase in addition also on a φ angle, and too on $\pi/2$ (see Fig.4). It means that two modes in one configuration coincide: a mode of a radial stationary wave and a mode of a circular stationary wave. I.e. we have in one configuration two stationary waves at once on two degrees of freedom. And it is very fundamental property of an electromagnetic field in particular and for a matter in general.

Radial dependence of amplitudes of all components of an electromagnetic field through functions `Rj_kr (1, R)` and `dRj_kr (1, R)` in this spherical configuration is presented on a Fig. 5.

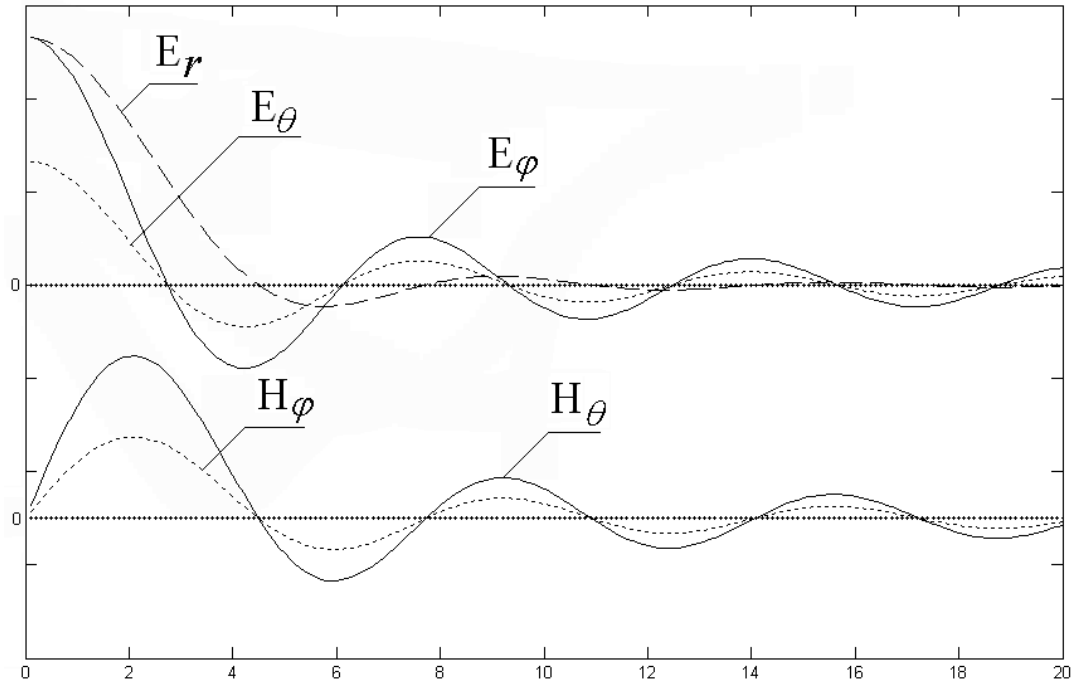

Fig.5
Radial dependence of amplitudes of field components

So, all spherical variants of possible electromagnetic fields round any particles, including elementary, are well known also can be always calculated by known formulas. These formulas are strict decisions of Maxwell's equations of for transverse magnetic (waves of E-type with $E_r \neq 0$) or transverse electric waves (a wave of H-type with $H_r \neq 0$). Each such decision describes the concrete wave configuration characterized by only two integers *m* and *n*. Mathematically it means that in the nature there can be wave processes with rather limited sets of own functions or a linear combination of such functions if there are bases for occurrence of the mixed mode.

Whether however it is necessary to prove uniqueness of such decision? Certainly it is necessary. And we have presented such proof in our Russian-speaking brochure [2] (the Appendix 5), which is in sale since 2006, and in English-speaking brochure [3], which founders of pseudo-physics have strictly forbidden to sell since 2007 everywhere, except Russia. The same proof is presented here again in the [2, 3]. Thus the basic fact is proved: any, even the most difficult system, like a heap of dipoles, pyramids, cubes, hedgehogs or spiked mases, creates out around himself necessarily spherical system of waves. It is a question of such system, which we have discussed in this paragraph. Other types of spatial oscillatory systems essentially cannot exist. For example, linear vortexes, as in a tornado, and even toroidal vortexes of any sizes are possible and rather prevalent in gas medium. But such dynamic systems cannot exist in an electromagnetic field. They are absent there simply because it contradicts fundamental properties of a specific two-vortical electromagnetic field or, generally speaking, of this major component of the nature.

All it simplifies essentially the analysis of variants of possible electromagnetic processes in any environments.

§ 2. Interactions of particles through waves systems

Above we have found out that the electromagnetic field of a separate particle cannot be arbitrary. It can accept only quite statutory conditions, at least, outside of particles. But us interest as well the most minimum data on a field, which penetrate and in them. After all if on border of that space where there is each particle, are present simultaneously and its own field, and an external field both of them exist and inside too. It is obvious that own internal field and the induced external field interfere in a phenomenon, which we name a particle. And these vector fields summarize and deduct necessarily as vectors. Here this property of an electromagnetic field should be coordinated with that fact that all elementary particles are rather stable. It turns out that on the one hand the astable sum of fields in particles should lead to changes of its internal energy. And on the other hand it is known that particles are stable in the sense that they in it are stable in themselves. It means that the stabilization mechanism is put in particles, but not in forces from another world.

So, we should compare three facts. The first fact – all particles have own external electrodynamics' system, which is somehow connected with its internal part, which is unknown to us. The second fact – a particle co-operates with electromagnetic fields of other particles. Hence, particle is not completely independent of external fields. The third fact – the particle, i.e. its internal part, is stable.

These facts force us to take a detached view on process of interaction of particles by electrodynamics laws.

Let the pair of separate particles has got to our field of vision. We will consider that each of them represents uniform spherical wave system in which all components of a field are connected among themselves. Here not only one of electric or magnetic components is keep in mind, but all components of vectors **E** and **H**. Under laws of electrodynamics, which we already have considered above, this connection can be carried out on any of a component though all spherical wave system entirely will react necessarily. And connection can be and through a weak component, but inside will react a component with the maximum amplitude. In our example with the lowest type of spherical fluctuations external electric field can influence and through component E_θ (the Fig.3 and a Fig.5 see). But concrete reaction of system can be shown, for example, in E_r and E_φ components. Such are properties of a unified electromagnetic field of concrete system.

Electromagnetic fields of pair elementary particles can be represented schematically in open space Ω so, as it shows on Fig.6. Here gray circles designate conditionally internal areas of elementary particles, which parallel electric components have amplitudes as $E_{01} = E_1(0)$ and $E_{02} = E_2(0)$, where the badge 0 designates the middle of particles, which coincides with the beginning of their coordinates. And readout of functions E_{01} and E_{02} we will take in their first extremum, measured from the center of coordinates. It can be in the center if the amplitude extremum is located in the beginning of coordinates, as in a case with the upper graph in a Fig.5, or on a sphere surface, on which this extremum, as in a case with the bottom graph in a Fig.5 is reached. Thus, E_{01} and E_{02} – two once and for all set numbers, characteristic for particles of each grade and being their own stable characteristic.

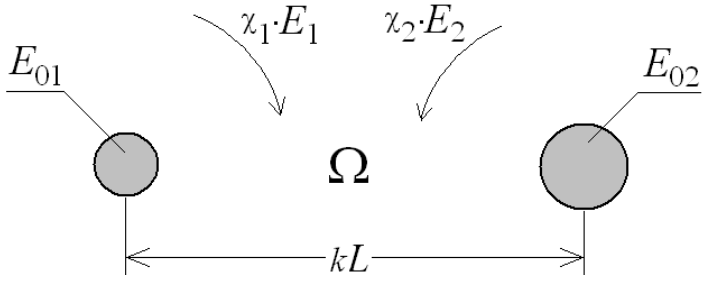

Fig. 6
The two-dimensional scheme of joint distribution of fields of two particles in space

It is clear that in view of presence of an interference of a field of one particle with a field of the opposite particle, each of these amplitudes is the vector sum of amplitudes of fields from both particles. The amplitude contains in the first particle, first of all, a component from this concrete first wave system with some factor χ_1 (the participation factor). This amplitude can be designated, as product $\chi_1 \cdot E_{01}$. But inside there is also a part of an external field. Its source is the field from the second particle. It not only is changed by distance (kL), but also by a symmetric interference in the second particle, which can be characterized in the factor χ_2. Therefore this component is equal $\chi_2 \cdot E_2(kL)$. In Fig.6 own components of electric field from two particles in external area Ω are designated without arguments by symbols $\chi_1 \cdot E_1$ and $\chi_2 \cdot E_2$. Here L is distance between particles as center-to-center.

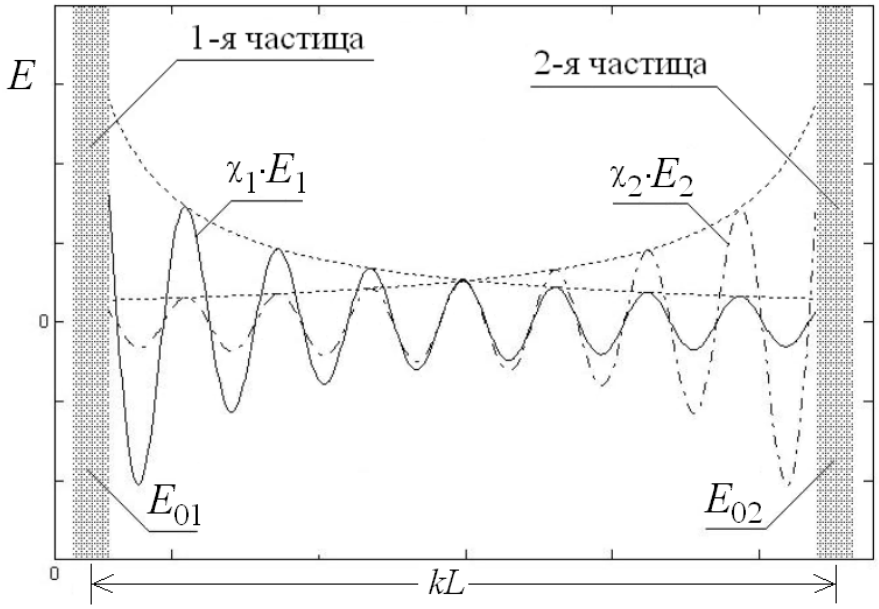

Fig.7
The one-dimensional scheme of interaction of variation fields of two particles in space

The one-dimensional picture of distribution of fields is presented schematically in a Fig. 7 where internal zones of particles are displayed by the vertical gray areas. Here electric field components $\chi_1 \cdot E_1$ and $\chi_2 \cdot E_2$ are presented graphically depending on distance between them. For the left particle this graph is spent by a continuous line, and for right – a dashed line. In this position both fields are summed in internal zones of particles. In other position can and be subtracted.

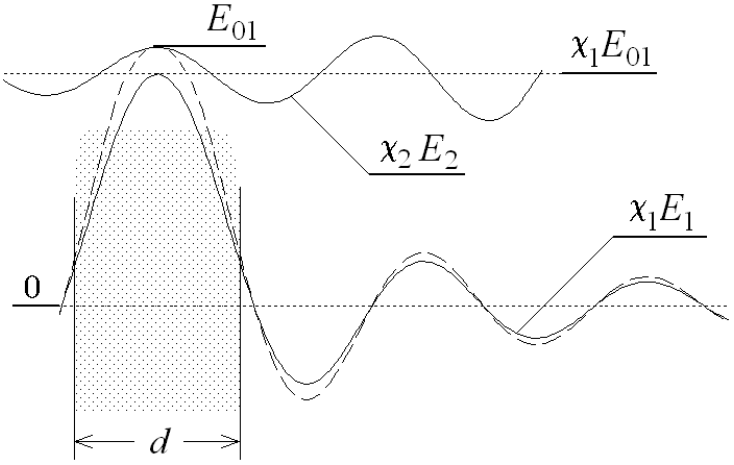

Fig.8
The scheme of addition of amplitudes in a particle

The Fig.8 shows process of addition of amplitudes of fields from two particles in the central zone of one of them. Here the graph of components amplitude of an **E**-field in single state of not cooperating particle is shown as a dotted line. Basically we do not know precisely that occurs in internal particles with a diameter *d*. However we can calculate a field on a border. It defines unequivocally and a field in an internal medium. It is called in the mathematician as analytical continuation. Here this effective field is stably, i.e. has the size fixed for a given particle or level which is designated as E_{01}. If this particle gets in the field of other particle ($\chi_2 \cdot E_2$), then the stable field – E_{01} will already consist of the sum of fields, in which the quota of own field occupies now not all field – E_{01} but only its part – $\chi_1 \cdot E_{01}$.

Thus, in particles, which we study here, there are some conditions, which stabilize there a quite special condition. It can be treated as a condition with stable internal energy or with stable total amplitudes of internal fields. But particles are under the influence of external fields. This influence grows out of interference. The resulted comparisons of the facts and reasoning allow us to write down a following equation for the first particle:

$$E_{01} = \chi_1 \cdot E_{01} + \chi_2 \cdot E_2(kL_{21}) \quad , \qquad (2)$$

where E_{01} is characteristic for this particle the stabilized level of amplitude in the center or on the sphere which center coincides with the particle center. The value χ_1 is the factor of participation of an external field of the first particle in its internal field, χ_2 is symmetric factor for the second particle, E_2 (kL_{21}) is amplitude of electric field from the second particle which is changed by distance between particles *kL*.

And now direct numerical experiment can be prepared. We concretize a problem under this goal.

First, we will limit our attention to interaction of identical particles. Then the condition will be satisfied: $\chi_1=\chi_2=\chi$. And we receive from (2):

$$\chi = \frac{E_{01}}{E_{01} + E_2(kL_{21})} \qquad (3)$$

Here we will notice that (3) loses meaning, if $E_{01}=0$. But we have already stipulated a condition: if the extremum is located in the center E_{01} it is calculated in the beginning of

coordinates of a particle. If the extremum is located on sphere E_{01} it is calculated on sphere with this center. Thus, the zero problems in the formula (3) are removed by this condition.

Secondly, we will choose those components of spherical electromagnetic fields, which will co-operate in our experiment. Based on images in a Fig.5, it is possible to prefer pair E_{φ} and H_{θ}, which can form a cross-section wave between particles.

Formulas (2) and (3) allow to execute direct computer calculation of a total energy of two co-operating particles W at different distances between particles $kL_{21} = kL_{12} = kL$. Results of such numerical experiment are presented in the form of graphs in a Fig.9. Here on an axis of abscises values of argument kL are postponed. Three functions of this argument are designated so: χ is participation factor, W is a relative total energy of system from two particles, F is force operating between particles which is counted up as an energy derivative with respect to the distance to honey by particles – kL. Two of parts of the graph are marked by vertical lines with symbols N and $N+2$, who correspond to normal dependence of the force operating between particles from kL: force of an attraction increases at increase in distance, and it decreases at distance reduction that testifies to a steady condition of all this system as a whole. It is easy to see that steady sites correspond to local minima of total energy W. But there are also abnormal sites. Here force – F between particles depends on distance in the reverse, abnormal form: the force decreases with increase in distance, and it decreases with the attraction increases that obviously testify to instability of this condition. Unstable conditions coincide with local maximums of energy – W. Thus, their resolved and forbidden zones in a system condition exist.

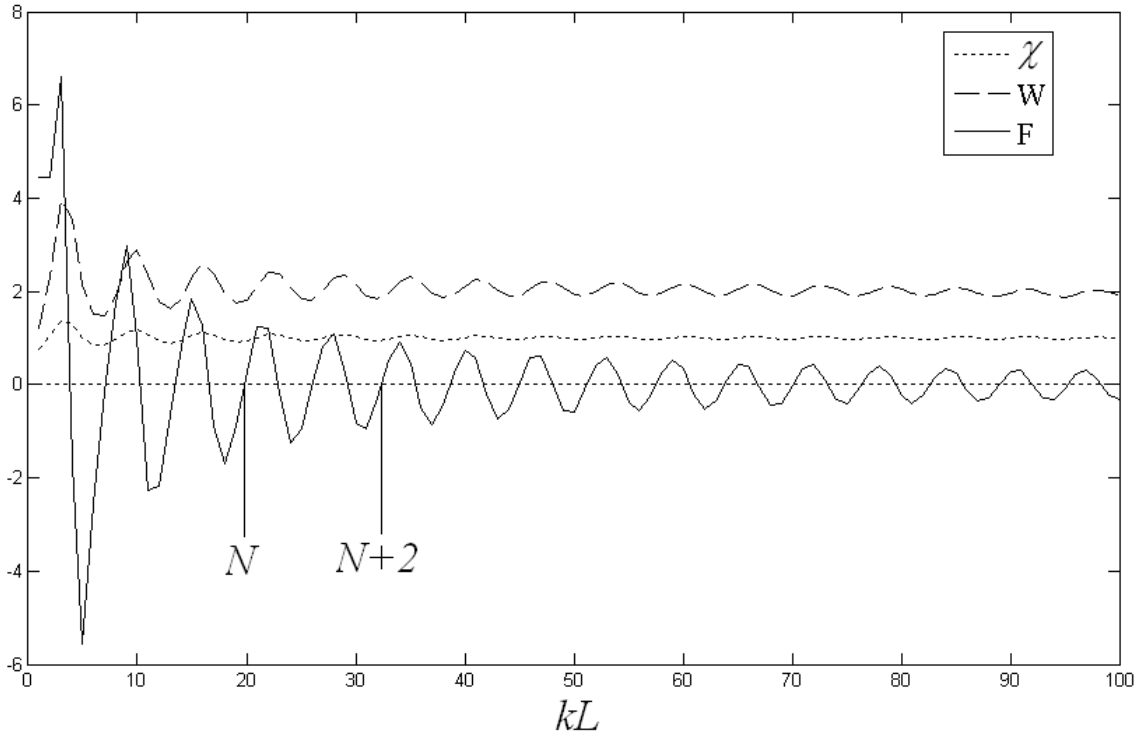

Fig.9

Dependence of the force operating between particles, on distance between them

It is obvious, that if external forces do not affect the considered system of particles, each resolved zone degenerates to be a point corresponding to 0 on axis F (kL). If the external forces exist, this point will be displaced accordingly, at first remaining within the zone. However too big forces will cause a break of the border, transferring the system into another steady or again transitive condition. Summing up this information, it is necessary to note, that the zonal principle of interaction regarded here is also called as quantum, which possesses a discrete spectrum of the resolved conditions.

Schedules in a Fig. 9 are received by means of the program presented more low. All amplitudes and distances have been set within the limits of the formula at $R_n(kR) = \sqrt{kR}J_{n+1/2}(kR)\,n$ = 1. But radial functions - `Rj_kr (R)` and – `dRj_kr (R)` have been applied to increase of speed of the account in their trigonometrical representation, instead of through Bessel's functions $J_{n+1/2}$ (kR). Corresponding subroutines are the same, as in the previous listing. Calculations are executed on the personal computer with operative memory 2 GB in space Ω, which contained 400x200x200 points.

```
%-------------------------------------------------------------------------
r0 = 5; m=200; n=2; % Parameters which are easily reconstructed

Y = cumsum(ones(n*m,m,m),2)-(m/2+0.5)*ones(n*m,m,m);
Z = cumsum(ones(n*m,m,m),3)-(m/2+0.5)*ones(n*m,m,m);
save tmp/U  Y Z;    clear Y Z;

for x = 1:100;

    X1 = cumsum(ones(n*m,m,m),1)-(n*m/2 +0.5 +r0 +x)*ones(n*m,m,m);
    X2 = cumsum(ones(n*m,m,m),1)-(n*m/2 +0.5 -r0 -x)*ones(n*m,m,m);
    load tmp/U;
    R1 = 0.5*(X1.^2 + Y.^2 + Z.^2).^(1/2);
    R2 = 0.5*(X2.^2 + Y.^2 + Z.^2).^(1/2);
    tet1=atan2((X1.^2+Y.^2).^(1/2),Z) ;   fi1=atan2(X1,Y) ;
    tet2=-atan2((X2.^2+Y.^2).^(1/2),Z) ;   fi2=atan2(X2,Y) ;
    clear X1 X2 Y Z ;

    Ef1 = -(dRj_kr(1,R1)./R1).*sin(fi1);
    Ef2 = -(dRj_kr(1,R2)./R2).*sin(fi2);

    [E0,b]= max( (Ef1(:,m/2,m/2)+Ef1(:,m/2-1,m/2)) );
    Es = (Ef2(b,m/2,m/2)+Ef2(b,m/2-1,m/2));
    se(x) =E0/(E0 + Es);        %The participation factor

    Et1 = (dRj_kr(1,R1)./R1).*cos(tet1).*cos(fi1);
    Et2 = (dRj_kr(1,R2)./R2).*cos(tet2).*cos(fi2);

    We1 = ((se(x)).^2).*( ...
        ( - Ef1.*sin(fi1) + Et1.*cos(tet1).*cos(fi1) ...
          - Ef2.*sin(fi2) + Et2.*cos(tet2).*cos(fi2)).^2 ...
       +(   Ef1.*cos(fi1) + Et1.*cos(tet1).*sin(fi1) ...
          + Ef2.*cos(fi2) + Et2.*cos(tet2).*sin(fi2)).^2 ...
       +( - Et1.*sin(tet1) ...
          - Et2.*sin(tet2)).^2 );
    We(x) = sum(sum(sum(We1)));
    clear Ef1 Ef2 Et1 Et2 We1

    Er1 = 2*(Rj_kr(1,R1)./(R1.^2)).*sin(tet1).*cos(fi1);
    Er2 = 2*(Rj_kr(1,R2)./(R2.^2)).*sin(tet2).*cos(fi2);
    Wer = ((se(x)).^2).*( ...
        (Er1.*sin(tet1).*cos(fi1) + Er2.*sin(tet2).*cos(fi2) ).^2 ...
       +(Er1.*sin(tet1).*sin(fi1) + Er2.*sin(tet2).*sin(fi2) ).^2 ...
       +(Er1.*cos(tet1)           + Er2.*cos(tet2) ).^2 );
    Wr(x) = sum(sum(sum(Wer)));
    clear Er1 Er2 Wer

    Ht1 = (Rj_kr(1,R1)./R1).*sin(fi1);
    Ht2 = (Rj_kr(1,R2)./R2).*sin(fi2);
    Hf1 = (Rj_kr(1,R1)./R1).*cos(tet1).*cos(fi1);
    Hf2 = (Rj_kr(1,R2)./R2).*cos(tet2).*cos(fi2);

    Wh1 = ((se(x)).^2).*( ...
        ( - Hf1.*sin(fi1) + Ht1.*cos(tet1).*cos(fi1) ...
          - Hf2.*sin(fi2) + Ht2.*cos(tet2).*cos(fi2)).^2 ...
```

```
       + (  Hf1.*cos(fi1) + Ht1.*cos(tet1).*sin(fi1) ...
          + Hf2.*cos(fi2) + Ht2.*cos(tet2).*sin(fi2)).^2 ...
       +( - Ht1.*sin(tet1) ...
          - Ht2.*sin(tet2)).^2 );
    clear R1 R2 fi1 fi2 tet1 tet2 Hf1 Hf2 Ht1 Ht2

    Wh(x) = sum(sum(sum(Wh1)));
    clear Wh1
    save tmp/W
end
W = We+Wr+Wh;
z=1:(size(W,2));
W0=sum(W(51:100))./50;
W=2*W./W0;
dW = diff(W); F = 4*cat(2,dW(1,1),dW);
plot (z,se,':',z,W,'--',z,F,'-',z,zeros(size(W)),':');
legend('se','W','F');
%-------------------------------------------------------------------------------
```

So, we have presented in this paragraph the most simple computer decision of a problem of electromagnetic interaction of two particles, proceeding from principles of a derivation of formulas (2) and (3). This solution has demonstrative character that results were clear even for nonspecialists. It is a question of student's of technical HIGH SCHOOL and of the advanced schoolboys. However the range of distances between particles in this decision is strongly limited by the size of a grid, which is defined by an element base of the computer.

§ 3. Gravitation

All massive bodies have the property of attraction to each other, without dependence from their charges or magnetic moments. Astronomers named this property as gravitation. It was revealed in the course of studying of trajectories of the planets, which different scientists have fixed in the course of astronomical supervisions. I.e. gravitation is the experimental fact described by the empirical formula:

$$F = \gamma \cdot \frac{M_1 \cdot M_2}{d^2} \quad , \qquad (4)$$

where F is force of an attraction between bodies, γ is gravitational constant, M_1 and M_2 are weights of gravitated bodies, d is distance between bodies.

As well as all empirical formulas, equality (4) is not absolutely exact. Therefore different scientists have already offered different amendments to it. But in general it is nevertheless the physical law.

It is possible to ask a question: whether has any relation to gravitation such simple electromagnetic interaction of elementary particles, which we studied in the previous paragraph? Naturally, the exact science electrodynamics, which works in any co-ordinates, should give the answer to it, but not free imagination with manipulations by a frame of reference.

We saw that the factor χ, which defines a share of own field of wave system of a particle in the sum of all fields, including and external, has basic value for calculations of forces of interaction between particles. Therefore we will look narrowly at this factor more attentively. The logic of a conclusion of formulas (2) and (3) is easy for extending to the group consisting from n of particles. Then for the first particle in system from many particles it is possible to present one of conditions of internal stability of the maximum amplitude so:

$E_{01} = \chi_1 \cdot E_1(0) + \chi_2 \cdot E_2(kL_{21}) + \chi_2 \cdot E_3(kL_{31}) + ... + \chi_n \cdot E_n(kL_{n1})$, where χ_1, χ_2, …, χ_n are factors of participation of particles, $E_m(kL_{mi})$ is amplitude of electric field m-й particles on a place i-й. And $kL_{mi} = k \cdot |\mathbf{r}_m - \mathbf{r}_i|$ are distances to honey the centers of particles with coordinates – $\mathbf{r}_m$ and $\mathbf{r}_i$, which is expressed in lengths of waves. The same reasoning can be applied and to other particles.

Then, the reduced designation $e_{mi} = E_m (kL_{mi})$ can be applied, and then the following system of the equations can be written down:

$$\begin{cases} E_{01} = \chi_1 \cdot E_{01} + \chi_2 \cdot e_{21} + \chi_3 \cdot e_{31} + ... + \chi_n \cdot e_{n1} \\ E_{02} = \chi_1 \cdot e_{12} + \chi_2 \cdot E_{02} + \chi_3 \cdot e_{32} + ... + \chi_2 \cdot e_{n2} \\ ..... \\ E_{0n} = \chi_1 \cdot e_{1n} + \chi_2 \cdot e_{2n} + \chi_3 \cdot e_{3n} + ... + \chi_n \cdot E_{0n} \end{cases} \quad (5)$$

The system of the equations (5) for $\chi_1, \chi_2, \ldots, \chi_n$ is linear. Therefore the area of existence of its decisions is limited only by one condition: a determinant $|\mathbf{M}| \neq$where square matrix **M** is composed of factors for variables $\chi_1, \chi_2, \ldots, \chi_n$. The estimation of area of existence of decisions demands to pay attention to relative size of elements of the first diagonal of matrix – **M**. Each of them can be much big in comparison with amplitude of not diagonal members, which decrease in inverse proportion to distance. Therefore in a problem about gravitation in which distances between particles $kL_{mi} >> 1$, the condition $|\mathbf{M}| \neq 0$ is carried out automatically. All other cases are connected not with gravitation, and with not less interesting near interaction which demand another, too individual studying.

It is easy to see that conditions of physical systems and the equations (5) in a condition vicinity $|\mathbf{M}| = 0$ testify to the moments of change of a determinant sign. And these moments are connected not with gravitation, but with not less interesting physical processes of transition of systems into qualitatively other conditions, including merges or divisions of co-operating elements or particles. Such merges, naturally, can occur in the world of microparticles only to change of corresponding indexes of Legender's functions. It is obvious that all these processes of merge and division demand other, more individual studying. However it is possible to tell beforehand that they are a key to understanding of the nature of nuclear forces and processes of formation of nuclear substance. Therefore (5) it is possible to name system of the characteristic equations.

But we will return to gravitation.

Let's give an example of the first decision (5), for example, for two particles:

$$\chi_1 = \frac{E_{01} \cdot E_{02} - e_{21} \cdot E_{02}}{E_{01} \cdot E_{02} - e_{12} \cdot e_{21}} = \frac{1 - \dfrac{e_{21}}{E_{01}}}{1 - \dfrac{e_{12} \cdot e_{21}}{E_{01} \cdot E_{02}}} = \left(1 - \frac{e_{21}}{E_{01}}\right) \cdot \left(1 + \frac{e_{12} \cdot e_{21}}{E_{01} \cdot E_{02}}\right). \quad (6a)$$

The similar decision for three particles is that:

$$\chi_1 = \left[1 - \frac{e_{21} + e_{31}}{E_{01}} + o\left(\frac{e_{21} + e_{31}}{E_{01}}\right)\right] \cdot \left(1 + \frac{e_{13} \cdot e_{31}}{E_{01} \cdot E_{03}} + \frac{e_{12} \cdot e_{21}}{E_{01} \cdot E_{02}} + \frac{e_{32} \cdot e_{23}}{E_{03} \cdot E_{02}}\right), \quad (6b)$$

where $o(x)$ there is a function, negligible small concerning of its argument, and size $E_{01}, E_{02}, \ldots$ are constant essence, characteristic and defined by the nature for each elementary particle individually. Here summands in the right brackets, which have order of the following smallness, too are rejected.

Let's pay attention on following two important feature, and for us the main properties, formulas (6).

First, all factors χ represent rather as specific functions from distances between particles. They represent not that other as constant unit, on which small deviations of the sinusoidal form are imposed. It is because all functions e_{mn} only in a near zone are defined through Bessel's functions, but in a distant zone interesting for us it is simply decreasing sinusoids. Naturally, any linear operations with these sinusoids remain too symmetric sinusoids. Squares of these functions could change a picture. But they are not present. Therefore even the first derivative on distance from these functions cleans at once constant unit and leaves periodic functions with zero average value.

In the second, in view of relation smallness of e_{mn} to E_{0n}, components of a following kind prevail in all χ_n on rather big distances in comparison with length of a wave:

$$\chi_n = 1 - \sum_{m \neq n} \frac{e_{mn}}{E_{0n}} \quad . \tag{6c}$$

Now we will consider more attentively interaction of two particles.

Gravitation search begins with calculation of a total energy of wave system as functions from distance between particles, i.e. from size $L_{12} = |\mathbf{r}_1 - \mathbf{r}_2|$, where $\mathbf{r}_1$ and $\mathbf{r}_2$ are coordinates of the centers of particles. In particular the energy of cooperating components of electric field W_1 can be counted up with the account (5) and (6) so (the multiplier k in these calculations for simplicity is believed further equal 1):

$$W_1(|\mathbf{r}_1 - \mathbf{r}_2|) = \frac{\varepsilon}{2} \int_{\infty} \left[\chi_1(|\mathbf{r}_1 - \mathbf{r}_2|) \cdot E_1(\mathbf{r}) + \chi_2(|\mathbf{r}_1 - \mathbf{r}_2|) \cdot E_2(\mathbf{r})\right]^2 d\mathbf{r}, \tag{7}$$

where $\mathbf{r}$ is point coordinates, and $d\mathbf{r}=dxdydz$ is a volume element in rectangular co-ordinates. Also it is necessary that the dielectric constant ε is equal 1.

As integration limits are infinite, it is possible to combine the beginning of coordinates with the center of the first particle. Then we receive such sum of integrals after squaring of binomial in square brackets:

$$W_1(|\mathbf{r}_2|) = \frac{1}{2} \int_{\infty} \chi_1(\mathbf{r})^2 \cdot E_1(\mathbf{r})^2 d\mathbf{r} + \frac{1}{2} \int_{\infty} \chi_1(|\mathbf{r} - \mathbf{r}_2|)^2 \cdot E_1(|\mathbf{r} - \mathbf{r}_2|)^2 d\mathbf{r} + \int_{\infty} \chi_1(\mathbf{r}) \cdot \chi_2(|\mathbf{r} - \mathbf{r}_2|) \cdot E_1(\mathbf{r}) \cdot E_2(|\mathbf{r} - \mathbf{r}_2|) d\mathbf{r} \quad . \tag{8}$$

The force operating between particles, is defined as derivative of total energy $W_{\text{п}}$ ($|\mathbf{r}_2|$) on distance $|\mathbf{r}_2|$. The first composed in (11) does not depend on this variable. Therefore and derivative of it is equal to zero, and the contribution to gravitation too the zero. The second composed symmetrically to the first according to (10). Therefore and its contribution to gravitation too is absent. Hence, we need to investigate only one, the third composed in (11). If we total factors χ on a component E_{φ}, then under a condition $|\mathbf{r}_2| = L$ and a relative positioning of particles along an axis y (see (4)), it is possible to receive the formula from the equation (11) for that energy of a φ-th component of an electromagnetic field of particles, which has the constant component depending from L:

$$W_{1\varphi}(L) = \int_{\infty} \left(1 - \frac{E_{\varphi 1}(L)}{E_{\varphi 01}}\right) \cdot \left(1 - \frac{E_{\varphi 2}(L)}{E_{\varphi 02}}\right) \cdot E_{\varphi 1}(\mathbf{r}) \cdot E_{\varphi 2}(|\mathbf{r} - \mathbf{r}_2|) d\mathbf{r}, \tag{9}$$

where, naturally, it is possible functions E_{φ} to take from the formula (4).

Further we will be limited to values of argument in radial functions R (x) and $d\text{R}(x)/dx$ from below so that $x > 10$. Then these functions (see the Fig.5) behave as $\sin(x)/x$ and $\cos(x)/x$. Now (9) it is possible to transform to a kind:

$$W_{1\varphi}(L) = \left(1 - \frac{\sin(L)}{LE_{\varphi 01}}\right)\left(1 - \frac{\sin(L)}{LE_{\varphi 01}}\right) \cdot \int_{\infty} \frac{E_{\varphi 01} \sin(\mathbf{r})}{\mathbf{r}} \cdot \frac{E_{\varphi 02} \sin(|\mathbf{r} - \mathbf{r}_2|)}{|\mathbf{r} - \mathbf{r}_2|} d\mathbf{r}. \tag{10}$$

The force operating between particles, is defined, naturally, differentiation on distance $L = |\mathbf{r}-\mathbf{r}_2|$. However both under integral, and before it in (9) and (10) we see one unit and many sinusoids. From unit the derivative is equal to zero, and sinusoids generate again periodic functions. The constant component which should decrease smoothly with distance and which should be responsible for gravitation, here cannot appear. All is easy for checking up it simple manipulations with formulas (9) and (10). It turns out so that the empirical law of gravitation (4) exists. But a direct component does not contain in (9) and (10), and even dimension at it does not coincide with

(4). Hence, the equation (10) does not describe properly that phenomenon, which we study. Therefore we should understand the physics process of interaction of particles slightly more deeply.

So, the formula (10) contains linear operations over periodic functions. All periodic functions have deviations from average value both in positive, and in negative the parties. As both these parties in linear system are equivalent, also the direct component does not vary or is equal to zero. There is only a periodic modulation.

However linear processes in the nature are not present. And the physicist has no bases to demand from electromagnetism of magic exceptions and to expect linearity from electrodynamics. We will pay attention, for example, to a Fig. 9. Whether positive and negative deviations from an average are equivalent there? Certainly the equivalence is not present: there positive deviations of energy correspond to the forbidden zones, and negative – resolved. On the big distances interdictions will smooth out possibly, but asymmetry of process remains. Here these nonequality reactions of the given nonlinear system to indignations of different directions should be reflected mathematically. Most easier to make it if in process of interaction of particles to bring an element of chance in sense of casual influence from outside other particles or something similar. Then preferences of this or that deviation it is shown very naturally. And the mathematics of similar problems is well fulfilled in the theory of casual processes. In it the probability as a preference measure exists, and in this case it is density of probability of conditions with different energies.

The integral (9) can be considered as an averaging operation on all volume of some function from energy. But this averaging is made in (9) everywhere with the identical weight equal 1. If there are preferences, for example statistical for some conditions of subintegral function instead of 1 there should be a multiplier, which is called as density of probability of conditions and is designated sometimes by a symbol w. It is not arbitrary, but reflects these preferences. And physical preferences for any system not isolated from an environment consist that its average density of energy aspires (relax) to a condition with average density of energy of an environment. This property of not closed systems is the law of the physics, which have been written down in the form of Gibbs distribution:

$$w = \frac{1}{Z} \cdot e^{-\frac{E}{k_B \cdot T}}, \qquad (11)$$

where w is density of probability of conditions of energy of subsystem E in the big system (called sometimes the thermostat) with average density of energy k_BT. Here the energy density as a tradition tribute (use even in the laser techniques) is expressed in thermodynamic categories: k_B is a Boltsman's constant, T is absolute temperature. Z is a normalizing multiplier which is called as the statistical sum and which gives a basis for calculation of free energy and other thermodynamic functions.

Exponent in (11) is not convenient for traditional linear operations. Therefore in thermodynamics it is accepted it expanded as a power series. Legitimacy of such approach is defined by condition $E << k_BT$ which in many problems is well carried out. We will arrive also as we too consider only that small share of the general energy which remained after rejection other composed in (8). And this share becomes even less with distance increase between particles L. Therefore this reception is pertinent and in our case, at least, as the first approach.

We here have distracted a lot of attention of the reader to widely known formula (11) only in order that he has seen, how a lot of information contains in ostensibly factor γ of the empirical formula (4) – it will appear also function of a condition of environment, in which gravitate at first sight independent bodies.

So, operation of averaging of subintegral expression in (9) with weight function (11) leads to such formula of energy of interaction of φ-th **E**-field components:

$$W_{\varphi}(L) = -\frac{\left(1-\frac{R(L)}{LE_{\varphi 01}}\right)^2\left(1-\frac{R(L)}{LE_{\varphi 01}}\right)^2}{Z}\cdot\int_{\infty}\left[\frac{E_{\varphi 01}R(\mathbf{r})}{\mathbf{r}}\cdot\frac{E_{\varphi 02}R(|\mathbf{r}-\mathbf{r}_2|)}{|\mathbf{r}-\mathbf{r}_2|}\right]^2 d\mathbf{r}. \quad (12)$$

Similarly we calculate energy of other components.

Results of calculations for two most intensive a component of spherical system – E_{φ} and H_{θ} – are illustrated in a Fig. 10. Here a shaped line represents the dependence graph of χ (Latin – chi) from distance between particles L. Dependence of force of gravitation is presented by two schedules in different scales – scale of the force illustrated with a continuous line in 200 times more by that which schedule is put by a line a stroke-dotted. The dashed line presents a usual square hyperbole for an illustration of average dependence of force of gravitation from distance between gravitate bodies. The period of a modulating variable components is increased is artificial here in 10 times by simple reception from stroboscopy, which details can be seen in applied listing.

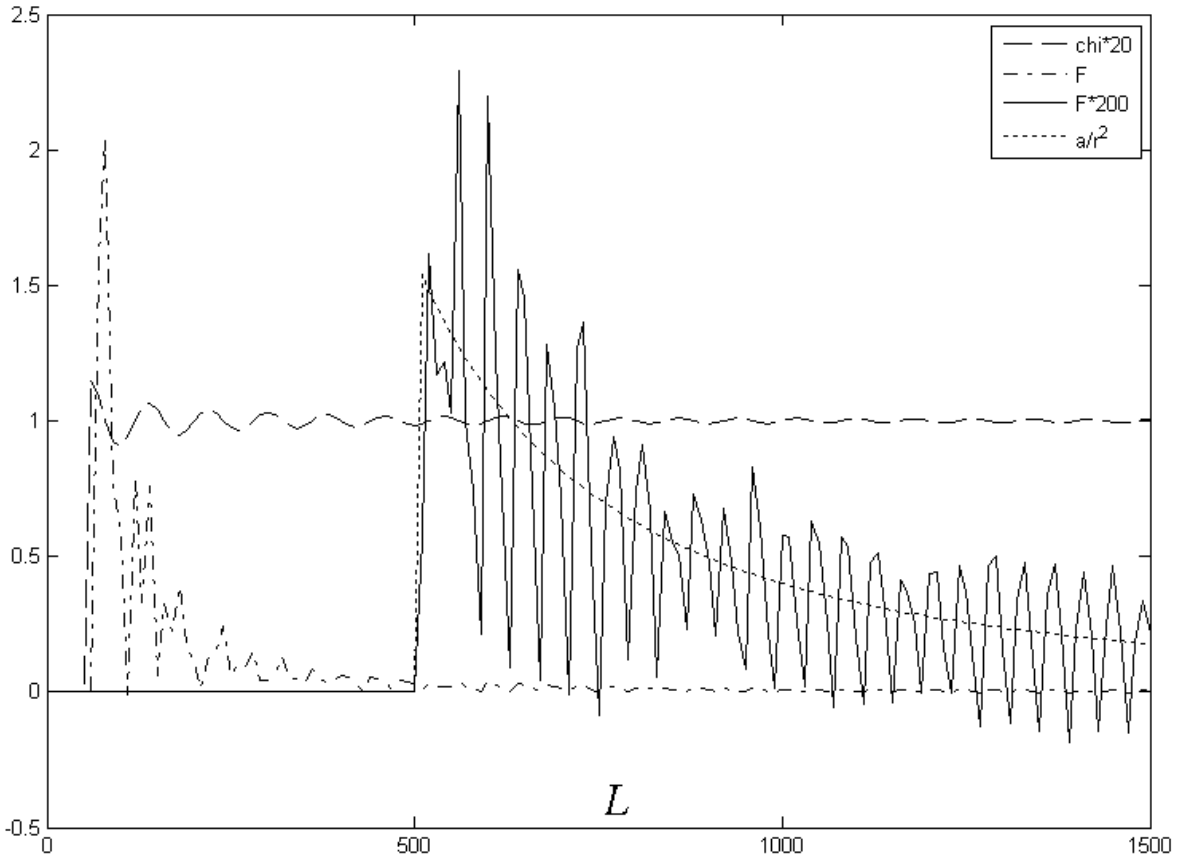

Fig.10
Settlement dependence of force of gravitation on distance between particles

The Fig. 10 shows that the direct component in the calculated dependence of force on distance submits to the law of proportional inverse relationship from a distance square, as well as in the formula (4). But here very strong variable modulation is added, which certainly does not affect a trajectory of planets in any way. But in our calculations for elementary particles of it was possible to expect. For example, similar on structure on (12) one-dimensional integral

$$I(L) = \int_{c}^{\infty}\left[\frac{\sin(r)}{r}\cdot\frac{\sin(r-L)}{r-L}\right]^2 dr \quad (13)$$

can be calculated in a symbolical form and gives in the answer too a constant component in the form of a square hyperbole with the strong modulation imposed on it which contains oscillations on frequency and amplitude.

The program text is presented lower.

```
%Script_Gravitation
%-----------------------------------------------------------------
Lmax = 150; m=200; n=2; k=10.25*pi; %10.25 – стробоскопическая константа
X = cumsum(ones(m,n*m,m),1)-(m/2 + 0.5)*ones(m,n*m,m);
Y = cumsum(ones(m,n*m,m),2)-(n*m/2+0.5-Lmax/2)*ones(m,n*m,m);
Z = cumsum(ones(m,n*m,m),3)-(m/2+0.5)*ones(m,n*m,m);
R1 = k*sqrt(X.^2 + Y.^2 + Z.^2);
fi1= atan2(Y,X);

for x=5:Lmax
    R2 = k*sqrt(X.^2 + (Y-x*ones(size(Y))).^2 + Z.^2);
    fi2= atan2(Y-x*ones(size(Y)),X);

    E0 = -dRj_kr(1,0.0001)./0.0001;
    Es = -dRj_kr(1,k*x)./(k*x);
    chi(x)=1 - Es./E0;
    sh=chi(x).^4;

    We = sh*( (sin(fi1).*dRj_kr(1,R1)./R1).*(sin(fi2).*dRj_kr(1,R2)./R2) ).^2;
    Wh = sh*( (sin(fi1).* Rj_kr(1,R1)./R1).*(sin(fi2).* Rj_kr(1,R2)./R2) ).^2;
    W(x) =10000*(0.0001 - sum(sum(sum(We+Wh)))/(m^3)); %
    clear Wd fi2 R2;

    save tmp/W chi W;
end
%--------    Plot    ----------------------------------------
z=10*(1:(size(W,2)));
W0 = sum(W)/size(W,2);
W1=W./W0; dW = diff(W1);
F = 2.2*(10^10)*cat(2,zeros(1,6),dW(:,6:size(dW,2)));
F1 = 1.2*(10^12)*cat(2,zeros(1,50),dW(:,50:size(dW,2)));
z1=cat(2,ones(1,50)*10^5,z(:,51:size(z,2)));
y=(4*10^5)*ones(size(z1))./((z1).^2);
chi1=cat(2,zeros(1,5),20*chi(:,6:size(z,2))-19*ones(1,size(z,2)-5));
plot (z,chi1,'--',z,F,'-.',z,F1,'-',z,y,':');
legend('chi*20','F','F*200','a/r^2');
%-----------------------------------------------------------------
```

It is necessary to emphasize, that the equation (12) and Fig.10 are fair in very wide range of distances. And what then value Fig.9 is? Apparently, it has only illustrative value, as an intermediate link in logic of a conclusion of the main equation (12).

Conclusion

We have discussed in the previous three paragraphs all aspects of interaction of elementary particles from position of electrodynamics. This science, as it is known, is born from experiments and is checked reliably up by them. Therefore our research does not contain postulates or hypotheses, and does not lean against them in any degree. As a result we managed to define unequivocally the nature of quantum forces and gravitation. Thus all mathematical apparatus used by us basically is not beyond school algebra. Only in §3 it was required at gravitation calculation to address to concept of integral about which not only the student, but also the schoolboy can enquire in the directory or any mathematical package for the elementary personal computers. For example, the popular mathematical package for the personal computer calculates in the symbolical form and for fractions of a second the integral (13), which explains through mathematics the mechanism of

occurrence of modulation – all without questions, imaginations and doubts. Moreover, all graphic material, which we tried to present, can to dispel without mathematics the fog of mysticism round the modern physics, which was filled with fussy falsifiers. We have accompanied all images texts by programs, with which help they have been calculated and constructed. They can seem not optimum or primitive for the expert, but we did not put other problems, except simplicity and presentation. Now even the schoolboy can check up calculations and experiment itself in this problem area of physics. And it is all together means: now any schoolboy can understand all sources and properties of all existing fields – enough its inquisitiveness and trust to directories in which the necessary formulas are published for the description of the elementary electromagnetic field systems for a long time.

So, we have found out the electrodynamics nature of quantum forces and gravitation. However it is a lot or a little for a physics science? The irrefragable answer will be given by the subsequent researches. But something it is possible to tell and now. It is solved in essence, and more exact: the notorious problem of "a unified field» is removed from the agenda.

In passing we have confirmed on an example of a gravitational constant that anything linear does not happen in the nature. And each "constant" appear sooner or later as coefficient at expanding as a power series of the function, unknown to us. These values only seem constants in view of inevitable limitation of those conditions in which empirical formulas have been received. Actually at expansion of a range of measured sizes or боле deep of studying processes they always depend on something else, breaking linearity of empirical laws. Really, why the nature should be arranged under a linear notation and the linear operators who have been thought up by the person? Actually nobody allocated this person with such command responsibility.

One more very important, completely not indifferent for natural sciences (the physicist, chemistry, genetics etc.) the aspect has emerged at our studying of interactions: it is spatial structure of quantum connections. We studied interaction of particles in paragraphs §2 and §3 in that mutual orientation, which have chosen from convenience reasons. However for a full physical picture of quantum interaction it is necessary to consider the factor of angular spatial synchronization of elementary particles on θ and φ as well. The sense of angular synchronization of electric **E** and magnetic **H** fields can be understood by analyzing Fig.2 and Fig.3. It represents spatial configurations **E** and **H,** and to be more exact - their components E_r and H_θ at three indexes of Legendre polynomials P_1^1, P_3^3 and P_3^2. The opposite phases of the fields are conditionally divided by means of color. Naturally, the whole picture is even richer in components - three times as rich.

Fig. 2 and Fig. 3 shows, that the spatial distribution of the fields has the form of beams, starting from the center. And the total amount of these beams increases according to the indexes of Legendre polynomials, but not in regular intervals. The amplitudes and phases of the fields in each of the beams submit to the known law, described by Bessel functions of the semi-whole argument. Naturally they also oscillate in time in conformance with the periodic law.

Let's underline a special importance of the problem of mutual angular synchronization of particles or clusters of them in order to understand the structure of the substance and the matter. This synchronization has the following consequences. First, the spatial angular distribution of fields does not rotate by itself (such is the exact solution of the problem – Appendices 1 and 2), i.e. it possesses gyroscopic stability. Therefore no "orbits" are present in the valid microcosm. Secondly, synchronization is carried out not on one of the fields, but on two simultaneously – **E** and **H**. Thirdly, synchronization leads to spatial quantization of the resolved conditions in such a way, that only some mutual orientations give steady resolved conditions. The combination of all the three consequences of mutual synchronization of particles and clusters causes strict spatial determinancy of structure of atoms, molecules and crystals constructed of them.

Thus, conditions of synchronization of variation fields define the spatial configurations from atoms to molecules. For example, an even number of electrons in each filled electronic cover of an atom can be explained by a corresponding symmetry of attached Legendre polynomials. The following stages of the matter structuring are molecules, gases, liquids and firm bodies dealt with by Newton’s mechanics and the statistical mechanics. The further chain of similar reasonings leads

to the comprehension of all the known structure of the matter, including not only crystals, but also genomes of live organisms.

The condition of many particles on very small distances between their centers should be noted especially. In this case the determinant of system of the equations (5) tends to zero. It means that especially strong connection at rapprochement of particles can cause their merge to nuclear substance. I.e. we clear up as well the problem of an origin of nuclear forces.

All electromagnetic fields of round particles in the basic condition have character of stationary waves. All of them are balanced at rest. And what will be, if there will be an event which will break the established balance of system of stationary waves? And all is simple: in this event will initiate the wave process of a relaxation with an moving of electromagnetic energy – usual cross-section electromagnetic waves will extend till that time, until the new balance will not be established. But to understand physics of process of movement and релаксационных processes in the world of real material objects, it is necessary to solve or, at least, to try to search solution of the equations in concrete boundary and entry conditions, avoiding imaginations, assumptions and councils of composers of jokes about physics.

Generally speaking, this research has mentioned rather a taboo subject. As we marked in the preface, even unsurpassed Dirak has been compelled to follow a taboo and to ignore electrodynamics. Therefore he did not give rightful place in the general physics for her. We have taken a step against this forced, absolutely unnatural fashion.

The calculations presented above and conclusions from them testify that the most initial experimental data about the properties of elementary particles in a combination with usual electrodynamics can give answers to many questions of principle of quantum mechanics and the gravitation theory. And all it is without postulates, hypotheses and fairy tales.

In particular we have easily established the following:

1. Any elementary particle is surrounded by a variable electromagnetic field, which it radiates and absorbs in the stationary waves mode. This field is calculated by well-known formulas.
2. All elementary particles interact among themselves through a variable electromagnetic field without dependence upon constant charges and their moments. The main type of interaction of elementary particles and their separate congestions among themselves is the sharply expressed quantum type.
3. All physical space known to us is filled by the variable electromagnetic field, which is the sum of fields, generated by a set of elementary particles. This material variable electromagnetic field has its energy, which can be identified as the dark matter discovered by astronomers, or as aether, so persistently searched for by Maxwell.
4. Variables and constant electromagnetic fields deprive of urgency a hypothesis about a neutrino existence since it has arisen from a problem of interpretation of a continuous spectrum of electrons energy at beta disintegration. But this disintegration occurs in the real-life field medium. And these mediums and a field should participate necessarily in balance of forces, energies and impulses that has not been considered by the author of a hypothesis.
5. Comparing a Fig. 2 and a Fig. 3, it is easy to notice that the zone of interaction of particles system is increased essentially in process of increment of their complexity. And we know that real-life molecules possess sufficient complexity to create for a long time the Kazimir's forces fixed by experiment.
6. In the structures formed by particles and their congestions there are no orbits, and there is only spatial quantization caused by the mutual angular synchronization of elementary particles or clusters from them, representing elements of this or that order of the organization of the matter.
7. Gravitation has the electromagnetic nature of origin and is connected with the coherent part of interaction of congestions of particles on distance.

8. The separate gravitational field is not present as it is, and hence there are no hypothetical gravitational waves, which some experimenters try to find out so unsuccessfully.
9. Especially it is necessary to note complexity of that physical mechanism, which is hidden behind the gravitational ostensibly "constant". In this case we have found out that γ is a function, which has a denominator containing the statistical sum. But this sum concerns the big system, which contains all gravitate bodies. Therefore our decision has far-reaching consequences for thermodynamics of all Universes.

Once again we will accentuate that above we have listed not hypotheses and not any models, but real consequences from laws of electrodynamics and the facts fixed by direct experiments with elementary particles.

The total sum of physical properties of elementary particles surrounded with variable and constant electromagnetic fields and their congestions result from particles` interaction through this field. It is present always and everywhere in the world known to us, making the dark matter or aether maintenance.

The simple explanation of the arrangement of this world stems out of this: its elements are only particles and clusters from them. And these particles, and clusters of different degree of integration from atoms to molecules and hard bodies are connected among themselves by variable and constant electromagnetic fields. There are no other elements and connections in the nature.

And nothing out of the above-found can be seen or assumed even hypothetically unless Maxwell's theory of electromagnetic fields is used in due time and manner. For this theory is an absolutely reliable and necessary tool of knowledge, constructed exclusively upon experience, and is an integral part of the subject of physics. And if we look at the retrospective, it will become obvious that neglect of this science by the physicists of the 20th century has had the most negative consequences for the physics itself. The forced deformation of physics to a surrealistic condition has rejected back development of this science and in general all philosophy more than for 100 years.

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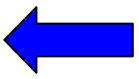

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