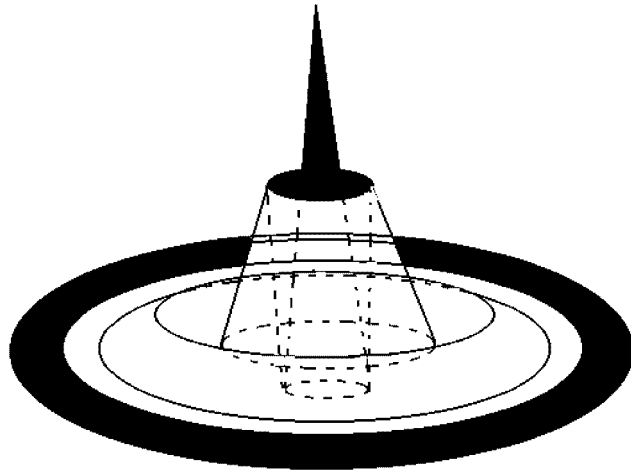


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PLANE-SYMMETRIC MAGNETO-FLUID UNIVERSE WITH TIME DEPENDENT COSMOLOGICAL TERM Λ

A. Pradhan¹ \blacktriangle , K.D. Thengane² \blacklozenge , J.K. Jumale³ \clubsuit

\blacktriangle *Department of Mathematics, Hindu Post-graduate College (V. B. S. Purvanchal University), Zamania-232 331, Ghazipur, India*

\blacklozenge *Department of Mathematics, R. S. Bidkar College, Hinganghat-442 301, Wardha (M. S.), India*

\clubsuit *Department of Physics, R. S. Bidkar College, Hinganghat-442 301, Wardha (M. S.), India*

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The behaviour of magnetic field in plane-symmetric homogeneous cosmological models is investigated for bulk viscous distribution. The coefficient of bulk viscosity is assumed to be a power function of mass density ($\xi = \xi_0 \rho^n$). The values of cosmological constant for these models are found to be small and positive which are supported by the results from recent supernovae Ia observations. Some physical and geometric aspects of the models are also discussed.

1. Introduction

In recent years, models with relic cosmological constant Λ have drawn considerable attention among researchers for various aspects such as the age problem, classical tests, observational constraints on Λ , structure formation and gravitational lenses have been discussed in the literature. It is remarkable here that in the absence of any interaction with matter or radiation this would force the cosmological constant to be constant, but, in the presence of the interaction with matter or radiation, a solution of Einstein's field equation and assumed equation of covariant conservation of energy with a time varying Λ can be found. For these solutions, conservation of energy requires that any decrease in the energy density of the vacuum component be compensated for by a corresponding increase in the energy density of matter or radiation. Some of the recent discussions on the cosmological constant "problem" and consequence on cosmology with a time-varying cosmological constant are contained in Bertolami [1], Ratra and Peebles [2], Dolgov [3]–[5], Sahni and Starobinsky [6], Padmanabhan [7], Carroll *et al.* [8], Vishwakarma [9] and Pradhan *et al.* [10]. Recent observations by Perlmutter *et al.* [11] and Riess *et al.* [12] strongly favour a significant and positive Λ . Their finding arise from the study of more than 50 type Ia supernovae with redshifts in the range $0.10 \leq z \leq 0.83$ and suggest Friedmann models with negative pressure matter such as a cosmological constant, domain walls or

cosmic strings (Vilenkin [13], Garnavich *et al.* [14]). Recently, Carmeli and Kuzmenko [15] have shown that the cosmological relativity theory (Behar and Carmeli [16]) predicts the value $\Lambda = 1.934 \times 10^{-35} s^{-2}$ for the cosmological constant. This value of Λ is in excellent agreement with the measurements recently obtained by the High-Z Supernova Team and Supernova Cosmological Project (Garnavich *et al.* [14]; Perlmutter *et al.* [11]; Riess *et al.* [12]; Schmidt *et al.* [17]). The main conclusion of these works is that the expansion of the universe is accelerating.

The standard Friedmann-Robertson-Walker (FRW) cosmological model prescribes a homogeneous and an isotropic distribution for its matter in the description of the present state of the universe. At the present state of evolution, the universe is spherically symmetric and the matter distribution in the universe is on the whole isotropic and homogeneous. But in early stages of evolution, it could have not had such a smoothed picture. Close to the big bang singularity, neither the assumption of spherical symmetry nor that of isotropy can be strictly valid. So we consider plane-symmetric, which is less restrictive than spherical symmetry and can provide an avenue to study inhomogeneities.

Most cosmological models assume that the matter in the universe can be described by 'dust' (a pressureless distribution) or at best a perfect fluid. However, bulk viscosity is expected to play an important role at certain stages of expanding universe [18]–[20]. It has been shown that bulk viscosity leads to inflationary like solution [21], and acts like a negative energy field in an expanding universe [22]. Bulk viscosity is associated with the Grand Unification Theories (GUT)

¹E-mail: acpradhan@yahoo.com, pradhan@iucaa.ernet.in

²E-mail: theganekd@yahoo.com

³E-mail: jumalejk@yahoo.com

phase transition and string creation. Thus, we should consider the presence of a material distribution other than a perfect fluid to have realistic cosmological models (see Grøn[23] for a review on cosmological models with bulk viscosity). A number of authors have discussed cosmological solutions with bulk viscosity in various context[24] – [26].

The occurrence of magnetic fields on galactic scale is well-established fact today, and their importance for a variety of astrophysical phenomena is generally acknowledged as pointed out Zeldovich *et al.*[27]. Also Harrison[28] has suggested that magnetic field could have a cosmological origin. As a natural consequences, we should include magnetic fields in the energy-momentum tensor of the early universe. The choice of anisotropic cosmological models in Einstein system of field equations leads to the cosmological models more general than Robertson-Walker model[29]. Several authors [30] – [35] have investigated cosmological models with a magnetic field in different context.

Motivated by the situations discussed above in regard with bulk viscous cosmologies, in this paper, we revisited the work of Bali [36] by including an electrically netral bulk viscous fluid by taking the coefficient of bulk viscosity to be a power function of mass density. We shall also focus upon the problem of establishing a formalism for studying the general relativistic evolution of magnetic homogeneities by considering a time dependent cosmological term in presence of bulk viscous in an expanding universe.

2. The Magnetic Fluid Universe Revisited

In this section, we review the solutions obtained by Bali [36]. We consider an anisotropic homogeneous Bianchi type I metric in the form given by Marder[37]

$$ds^2 = A^2(dx^2 - dt^2) + B^2dy^2 + C^2dz^2, \quad (1)$$

where the metric potentials are functions of t only. The distribution consists of an electrically neutral viscous fluid with an infinite electrical conductivity and magnetic field. The energy momentum tensor is taken into the form of viscous fluid [38]

$$T_{ij} = (\rho + p)v_i v_j + p g_{ij} - \eta(v_{i;j} + v_{j;i} + v_j v^l v_{i;l} + v_i v^l v_{j;l} - \left(\xi - \frac{2}{3}\eta\right)v_{;l}^l(g_{ij} + v_i v_j) + E_{ij}, \quad (2)$$

where E_{ij} is the electro-magnetic field given by Licherowicz[39] as

$$E_{ij} = \bar{\mu} \left[|h|^2 \left(v_i v_j + \frac{1}{2} g_{ij} \right) - h_i h_j \right]. \quad (3)$$

Here ρ is density, p is pressure, η and ξ are the coefficients of shear and bulk viscosity respectively and v^i is the flow vector satisfying the relation

$$g_{ij}v^i v^j = -1. \quad (4)$$

$\bar{\mu}$ is the magnetic permeability and h_i the magnetic flux vector defined by

$$h_i = \frac{1}{\bar{\mu}} {}^*F_{ji}v^j, \quad (5)$$

where ${}^*F_{ij}$ is the dual electro-magnetic field tensor defined by Synge [40] to be

$${}^*F_{ij} = \frac{\sqrt{-g}}{2} \epsilon_{ijkl} F^{kl}. \quad (6)$$

F_{ij} is the electro-magnetic field tensor and ϵ_{ijkl} is the Levi-Civita tensor density. Here, the comoving coordinates are taken to be $v^1 = 0 = v^2 = v^3$ and $v^4 = \frac{1}{A}$. We take the incident magnetic field to be in the direction of x -axis so that $h_1 \neq 0$, $h_2 = 0 = h_3 = h_4$. This leads to $F_{12} = 0 = F_{13}$ by virtue of (5). Also due to assumption of infinite conductivity of the fluid, we get $F_{14} = 0 = F_{24} = F_{34}$. Hence, the only non-vanishing component of F_{ij} is F_{23} . The first set of Maxwell's equation

$$F_{ij;k} + F_{jk;i} + F_{ki;j} = 0, \quad (7)$$

leads to $F_{23} = \text{constant} = I$ (say). Hence

$$h_1 = \frac{AI}{\bar{\mu}BC}. \quad (8)$$

The Einstein's field equations with time-dependent cosmological constant ($c = 1$, $G = 1$ in gravitational unit)

$$R_i^j - \frac{1}{2} R g_i^j + \Lambda g_i^j = -8\pi T_i^j, \quad (9)$$

for the line element (1) has been set up as

$$8\pi A^2 \left[p - \frac{2\eta A_4}{A^2} - \left(\xi - \frac{2}{3}\eta \right) v_{;l}^l - \frac{I^2}{2\bar{\mu}B^2C^2} \right] = -\frac{B_{44}}{B} - \frac{C_{44}}{C} - \frac{B_4C_4}{BC} + \frac{A_4B_4}{AB} + \frac{A_4C_4}{AC} - \Lambda A^2, \quad (10)$$

$$8\pi A^2 \left[p - \frac{2\eta B_4}{AB} - \left(\xi - \frac{2}{3}\eta \right) v_{;l}^l + \frac{I^2}{2\bar{\mu}B^2C^2} \right] = -\frac{A_{44}}{A} - \frac{C_{44}}{C} + \frac{A_4^2}{A^2} - \Lambda A^2, \quad (11)$$

$$8\pi A^2 \left[p - \frac{2\eta C_4}{AC} - \left(\xi - \frac{2}{3}\eta \right) v_{;l}^l + \frac{I^2}{2\bar{\mu}B^2C^2} \right] = -\frac{A_{44}}{A} - \frac{B_{44}}{B} + \frac{A_4^2}{A^2} - \Lambda A^2, \quad (12)$$

$$8\pi A^2 \left[\rho + \frac{I^2}{2\bar{\mu}B^2C^2} \right] = \frac{A_4B_4}{AB} + \frac{A_4C_4}{AC} +$$

$$\frac{B_4 C_4}{BC} + \Lambda A^2. \quad (13)$$

The suffix 4 by the symbols A , B and C denote differentiation with respect to t . Equations (10)-(13) are four equations in seven unknowns, A , B , C , ρ , p , ξ , and Λ . The coefficient of shear viscosity and the magnetic permeability being assumed to be constants. Firstly, we assume that for a co-moving observer the magnetic flux is uniform in space and time coordinates so that h_1 is constant. This requires in virtue of Eq. (5) that A be proportional to BC . By a simple transformation of coordinates, one can take the proportionality factor to be unity. Thus

$$A = BC. \quad (14)$$

Following Bali [36], the solution of the field equations are obtain and by using a suitable transformation, the geometry of the universe (2) can be written into the form

$$dS^2 = \left(\frac{b^2}{M} + N \right) dX^2 - dT^2 + \left(\frac{b^2}{M} + N \right) (k dY^2 + k^{-1} dZ^2), \quad (15)$$

where

$$\begin{aligned} \log k &= \int K e^{-16\pi\eta T} dT \left[\frac{b^2}{M} + N \right] + \\ &\quad \log \left[\frac{\ell^2 K/b}{(4b\sqrt{2\pi\eta} + a)^{K/b}} \right], \\ L &= 16\pi\eta b + a^2, \\ M &= 8\pi\eta + a^2, \\ N &= -\frac{1}{8\pi\eta} \left[\frac{L e^{-16\pi\eta T} - a^2}{16\pi\eta} + a^2 T - \frac{a^2}{16\pi\eta} \log \left(\frac{L}{a^2} \right) \right], \\ a^2 &= \frac{16\pi I^2}{\bar{\mu}}, \end{aligned}$$

and b , ℓ and K are arbitrary constants.

The pressure and density of the model (15) are given by

$$\begin{aligned} 8\pi p &= \frac{1}{S} \left[\frac{5(L e^{-16\pi\eta T} - a^2)^2}{4S(16\pi\eta)^2} - \frac{K^2 e^{-32\pi\eta T}}{4S} + \right. \\ &\quad \left. \frac{3L e^{-16\pi\eta T}}{2} + 8\pi\eta K e^{-16\pi\eta T} + \right. \\ &\quad \left. \left(\xi - \frac{2}{3}\eta \right) \left(\frac{L e^{-16\pi\eta T}}{\eta} - \frac{a^2}{4} \right) \right] - \Lambda, \quad (16) \end{aligned}$$

$$\begin{aligned} 8\pi\rho &= \frac{1}{4S} \left[\frac{5(L e^{-16\pi\eta T} - a^2)^2}{S(16\pi\eta)^2} - \frac{K^2 e^{-32\pi\eta T}}{S} - a^2 \right] \\ &\quad + \Lambda, \quad (17) \end{aligned}$$

where

$$S = \frac{b^2}{M} + N.$$

3. Bulk Viscous Solutions in the Presence of a Magnetic Field

The expansion scalar θ is given by

$$\theta = \frac{L e^{-16\pi\eta T} - a^2}{8\pi\eta S}. \quad (18)$$

For the specification of ξ , now we assume that the fluid obeys an equation of state of the form

$$p = \gamma\rho, \quad (19)$$

where $\gamma(0 \leq \gamma \leq 1)$ is a constant.

Thus, given $\xi(t)$ we can solve the cosmological parameters. In most of the investigations involving bulk viscosity is assumed to be a simple power function of the energy density [41] - [43].

$$\xi(t) = \xi_0 \rho^n, \quad (20)$$

where ξ_0 and n are constants. If $n = 1$, Eq. (20) may correspond to a radiative fluid [44]. However, more realistic models [45] are based on n lying in the regime $0 \leq n \leq \frac{1}{2}$.

3.1. Model I: solution for $n = 0$

When $n = 0$, Eq. (20) reduces to $\xi = \xi_0$ and hence in this case Eq. (16), with the use of Eqs. (17) and (19) leads to

$$\begin{aligned} 8\pi(1+\gamma)\rho &= \frac{1}{S} \left[\frac{5(L e^{-16\pi\eta T} - a^2)^2}{2S(16\pi\eta)^2} - \frac{K^2 e^{-32\pi\eta T}}{2S} \right. \\ &\quad \left. + \frac{5L e^{-16\pi\eta T}}{6} + 8\pi\eta K e^{-16\pi\eta T} + \right. \\ &\quad \left. \frac{L\xi_0 e^{-16\pi\eta T}}{\eta} + \frac{a^2}{12}(2\eta - 3\xi_0 - 3) \right]. \quad (21) \end{aligned}$$

Eliminating $\rho(t)$ between Eqs. (17) and (21), we get

$$\begin{aligned} (1+\gamma)\Lambda &= \frac{1}{S} \left[\frac{5(1-\gamma)(L e^{-16\pi\eta T} - a^2)^2}{4S(16\pi\eta)^2} - \right. \\ &\quad \left. \frac{(1-\gamma)K^2 e^{-32\pi\eta T}}{4S} + \frac{5L e^{-16\pi\eta T}}{6} + 8\pi\eta K e^{-16\pi\eta T} + \right. \\ &\quad \left. \frac{L\xi_0 e^{-16\pi\eta T}}{\eta} + \frac{a^2}{12}(2\eta - 3\xi_0 + 3\gamma) \right]. \quad (22) \end{aligned}$$

3.2. Model II: solution for $n = 1$

When $n = 1$, Eq. (20) reduces to $\xi = \xi_0 \rho$ and hence in this case Eq. (16), with the use of Eqs. (17) and (19) leads to

$$\rho = \frac{1}{\left[8\pi(1+\gamma)S - \xi_0 \left(\frac{L e^{-16\pi\eta T}}{\eta} - \frac{a^2}{4} \right) \right]} \times$$

$$\left[\frac{5(L e^{-16\pi\eta T} - a^2)^2}{2S(16\pi\eta)^2} - \frac{K^2 e^{-32\pi\eta T}}{2S} + 8\pi\eta K e^{-16\pi\eta T} + \frac{5L e^{-16\pi\eta T}}{6} + \frac{a^2}{12}(2\eta - 3) \right]. \quad (23)$$

Eliminating $\rho(t)$ between Eqs. (17) and (23), we get

$$\Lambda = \frac{1}{\left[1 + \gamma - \frac{\xi_0}{8\pi} \left(\frac{L e^{-16\pi\eta T}}{\eta} - \frac{a^2}{4} \right) \right] S} \times \left[\frac{5(1 - \gamma)(L e^{-16\pi\eta T} - a^2)^2}{4S(16\pi\eta)^2} - \frac{(1 - \gamma)K^2 e^{-32\pi\eta T}}{4S} + 8\pi\eta K e^{-16\pi\eta T} + \frac{5L e^{-16\pi\eta T}}{6} + \frac{a^2}{12}(3\gamma - 2\eta) + \frac{\xi_0}{32\pi} \left(\frac{L e^{-16\pi\eta T}}{\eta} - \frac{a^2}{4} \right) \times \left\{ \frac{5(L e^{-16\pi\eta T} - a^2)^2}{S(16\pi\eta)^2} - \frac{K^2 e^{-32\pi\eta T}}{S} - a^2 \right\} \right]. \quad (24)$$

From Eqs. (22) and (24), we observe that cosmological term Λ may be positive or negative under specific conditions. A negative cosmological term adds to the attractive gravity of matter; therefore, universe with a negative cosmological term is invariably doomed to recollapse. A positive cosmological term resists the attractive gravity of matter due to its negative pressure. For most universe, the positive cosmological term eventually dominates over the attraction of matter and drives the universe to expand exponentially. It is also observed that in both models the cosmological term Λ is a decreasing function of time which is consistent with the results of recent observations (Perlmutter *et al.*[11], Riess *et al.*[12], Garnavich *et al.*[14] and Schmidt *et al.*[17]).

4. Some Physical and Geometrical Features of the Models

We shall now give the expressions for kinematical quantities and the components of conformal curvature tensor. The scalar of expansion θ calculated for the flow vector v^i is already given by (18).

The rotation ω is identically zero and the shear in the model, is given by

$$\sigma^2 = \frac{(1 - 2S)}{32\pi\eta S} [L e^{-16\pi\eta T} - a^2]. \quad (25)$$

The deceleration parameter q and the linear dimension D_l are given by

$$q = -\frac{(L e^{-16\pi\eta T} - a^2)}{24\pi\eta S^2} \left[\frac{2L}{3} e^{-16\pi\eta T} + \frac{(8\pi\eta - 3)\{L e^{-16\pi\eta T} - a^2\}}{4608(\pi\eta)^3 S} \right], \quad (26)$$

$$D_l = k_1 S^{1/3}, \quad (27)$$

where k_1 is constant of integration.

The non-vanishing component of conformal curvature tensor are obtained as

$$C_{12}^{12} = -\frac{1}{S} \left[\frac{1}{2} L e^{-16\pi\eta T} + \frac{(L e^{-16\pi\eta T} - a^2)^2}{2S(16\pi\eta)^2} + 24\pi\eta K e^{-16\pi\eta T} + \frac{3K T e^{-16\pi\eta T}}{S} + \frac{K^2 e^{-32\pi\eta T}}{2S} \right], \quad (28)$$

$$C_{13}^{13} = -\frac{1}{S} \left[\frac{1}{2} L e^{-16\pi\eta T} + \frac{(L e^{-16\pi\eta T} - a^2)^2}{2S(16\pi\eta)^2} - 24\pi\eta K e^{-16\pi\eta T} - \frac{3K T e^{-16\pi\eta T}}{S} + \frac{K^2 e^{-32\pi\eta T}}{2S} \right], \quad (29)$$

$$C_{23}^{23} = \frac{1}{S} \left[L e^{-16\pi\eta T} + \frac{(L e^{-16\pi\eta T} - a^2)^2}{2S(16\pi\eta)^2} + \frac{K^2 e^{-32\pi\eta T}}{S} \right]. \quad (30)$$

Hence the spacetime is non-degenerate Petrov type-I in general. However, when $K = 0$ the metric (15) reduces to type D . The flow vector is geodesic and the models represent an expanding, shearing but non-rotating universe.

It is observed that when $T \rightarrow -\infty$, $S \rightarrow -\infty$. Also when $T \rightarrow \infty$, $S \rightarrow -\infty$. The function S has its maximum value S_m at

$$T = T_m = \frac{1}{16\pi\eta} \log \left(1 + \frac{16\pi\eta b}{a^2} \right),$$

given by

$$S_m = \frac{b^2}{8\pi\eta + a^2}.$$

Clearly $S_m > 0$. It is, therefore, obvious that S vanishes for two values of T , say T_1 and T_2 .

The model (15) starts expanding from its singular state at $T = T_1$ and attains its maximum linear dimension at $T = T_m$ when its expansion stops. There is no singularity at $T = T_m$ and contraction proceeds and finally at $T = T_2$, it implodes into a second singularity. If we assume the value of S at $T = 0$ to be positive, then it is clear that $T_1 < 0$ and $T_2 > T_m$. However, the model is restricted to be a lesser period of time by virtue of the reality condition. The expansion θ and the shear σ tends to zero as the model attains its maximum linear dimension. However, the rate of decrease of σ with time is less rapid compared to that of θ . Although the magnitude flux intensity vector has constant components in the comoving references frame, its magnitude decreases during the expansion phase of the universe. It is also to be noted that the magnetic energy decreases during this stage.

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ON THE DISPLACEMENTS OF EINSTEINIAN FIELDS *ET CETERA*

Angelo Loinger¹

Dipartimento di Fisica, Università di Milano, Via Celoria, 16 - 20133 Milano, Italy

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I give here: *i*) a very simple proof that the physical non-existence of gravitational waves (GW's) is quite consistent with the basic principles of general relativity (GR); *ii*) a new argument against the physical existence of GW's; *iii*) a criticism of Fock's treatment of the GW's; *iv*) some remarks on recent experimental investigations concerning the GW's.

1. The following is a widespread and erroneous opinion: *Without gravitational waves (GW's), one would have to explain an instantaneous propagation of a change in the metric over the whole universe simply by changing the distribution of stress or mass of a given physical system.* – In reality, the physical non-existence of GW's is quite consistent with the principles of general relativity (GR), as I have shown *ad abundantiam* in various papers [1], but perhaps in too concise ways insofar as the above specific belief is concerned. I shall give now in sects. 2., 3. a detailed treatment of it, with the hope of convincing even the most naive among the physicists that the adjective “instantaneous” is not the attribute of a relativistic bugaboo – if it is properly understood.

In sect. 4. I give a new argument against the physical existence of GW's. In sect. 5. Fock's computations concerning the GW's are critically examined. The **Appendix** reports some recent (negative) results of the experimental search of GW's due to LIGO collaboration.

2. In previous Notes I have repeatedly emphasized that Einstein field is *not* analogous to Maxwell field, since it has peculiar properties of its own that are not shared by the electromagnetic field. If, however, we neglect for a moment – *ad usum Delphini* – the existence of the e.m. waves, we can exploit a precise property of Maxwell field for our purpose. For convenience, I utilize here the treatment of Liénard-Wiechert e.m. fields – created by a moving point charge – as is developed in the well known treatise by Becker and Sauter [2]; see in particular p.293 of this book, which gives the expressions of the electric and magnetic fields due to Liénard and Wiechert. For our aim, it is expedient to consider the first part, say \mathbf{E}_1 , of the electric field \mathbf{E} (e.g.), i.e. the part which does not depend on the charge accele-

ration. We have

$$\mathbf{E}_1(\tau)/e = \left[\frac{(\mathbf{r} - r\mathbf{v}/c)(1 - v^2/c^2)}{(r - \mathbf{r} \cdot \mathbf{v}/c)^3} \right]_{\tau \equiv t - r/c}, \quad (1)$$

with evident and standard notations. As Becker and Sauter write, \mathbf{E}_1 has the character of a *static* field, it falls off as $1/r^2$ for large distances. Since eq. (1) gives the first part of the expression of the global field \mathbf{E} , which is valid for *all* velocities \mathbf{v} , it must agree with the field, say \mathbf{E}' , created by a uniformly moving charged particle (see sect. 64 of [2]):

$$\mathbf{E}'(t)/e = \frac{\mathbf{r}(1 - v^2/c^2)}{[r^2 - (\mathbf{r} \times \mathbf{v}/c)^2]^{3/2}}; \quad (2)$$

the formal difference between expressions (1) and (2) comes from the different meanings of the vector \mathbf{r} in the two formulae. In eq.(2) $\mathbf{r} = \mathbf{r}(t)$ is set equal to the vector from the *instantaneous* particle location, say B , to the field point P , while in eq.(1) by $\mathbf{r} = \mathbf{r}(\tau) \equiv \mathbf{r}(t - r/c)$ we understand the vector from the particle location, say A , at *retarded* time $\tau \equiv t - r/c$, to the field point P . For the case of *constant* velocity we obviously have:

$$\mathbf{r}(t) = \mathbf{r}(\tau) - \frac{r(\tau)}{c}\mathbf{v}. \quad (3)$$

If we write $\mathbf{r}(t) \equiv \mathbf{r}_0$, and $\mathbf{r}(\tau) \equiv \mathbf{r}$ (as in eq.(1)), we find from $\mathbf{r}_0 = \mathbf{r} - r\mathbf{v}/c$ for the denominator of eq. (2) that

$$\left[r_0^2 - (\mathbf{r}_0 \times \mathbf{v}/c)^2 \right]^{3/2} = (r - \mathbf{r} \cdot \mathbf{v}/c)^3, \quad (4)$$

i.e. the denominator of eq. (1). Thus the field \mathbf{E}_1 actually represents the field *moving along with the particle*; and this is clearly true also for a *non-constant* speed. By contrast, the second part, \mathbf{E}_2 , of the total electric

¹E-mail: angelo.loinger@mi.infn.it

field $\mathbf{E} = \mathbf{E}_1 + \mathbf{E}_2$, which is proportional to the acceleration $\dot{\mathbf{v}}$, has the character of a wavy $(1/r)$ - decreasing field.

(I have reproduced almost literally some passages of Becker and Sauter [2], only the italics are mine.)

3. We have seen that the *static* part \mathbf{E}_1 of Liénard-Wiechert electric field \mathbf{E} *moves en bloc with the particle*. Now, the *same* thing happens, in the *exact* formulation of GR, for the Einstein field $g_{jk}(x^0, \mathbf{x})$, $(j, k = 0, 1, 2, 3)$, since – as it has been proved [3] – *no “mechanism” exists in GR, which is capable of producing GW’s*. In other terms, if we displace a mass, its gravitational field and the related curvature of the interested manifold *displace themselves along with the mass*. In general, qualitatively speaking, we can affirm that under this respect Einstein field and Newton field behave in an identical way. This fact is mathematically and physically *evident* in Friedmann’s cosmological models, as I have shown [4], owing to the perfect agreement between Friedmann’s solutions and the solutions of corresponding Newtonian models. (Furthermore, we can remark that at any stage of the EIH-method of solution of field equations there is a suitable reference frame for which the solution has a *Newtonian* form.)

Conclusion: the widespread opinion reported at the beginning of sect.1 is *false*: the absence of GW’s does not generate any theoretical difficulty – as Levi-Civita had pointed out many years ago.

(Generally speaking, the real existence of *physical* waves requires the existence of *physically* privileged reference frames, or of a *material* medium as the cosmic ether. It is not the case of GR: in it a geodesic deviation must have a *Newton*-like character – and therefore could be recorded only by an apparatus in a relative proximity of the gravity source.) –

4. The Einstein field equations share with Laplace-Poisson equation $\nabla^2 U = -4\pi G\rho$ an important property. Let us consider for a moment only the case of a “cloud of dust” with mass tensor $T^{jk} = \rho u^j u^k$, $(j, k = 0, 1, 2, 3)$, where $\rho(x^0, \mathbf{x})$ is the invariant mass density and $u^j(x^0, \mathbf{x})$ is the four-velocity of a gravitating particle. It is well known [5] that we can always choose a Gaussian normal (“synchronous” in Landau’s terminology [6]) reference frame, for which:

$$ds^2 = (dx^0)^2 - h_{\alpha\beta}(x^0, \mathbf{x}) dx^\alpha dx^\beta, (\alpha, \beta = 1, 2, 3); (5)$$

if there are only gravitational interactions – as in the present case, – this frame is also co-moving [7]: the *world* lines of the “dust” particles are both *time* lines and *geodesic* lines. Our mass tensor T^{jk} has only the component $T^{00} = \rho$ different from zero. *Thus* – exactly as it happens for Friedmann’s models [4] – *the metric tensor $g_{jk}(x^0, \mathbf{x})$ depends only on $\rho(x^0, \mathbf{x})$* , in perfect analogy with the Newtonian potential U , and it satisfies *identically* the geodesic equations. No GW’s are

emitted – and this fact is now quite intuitive, because we see that the motion of the fluid has been formally “obliterated”.

This treatment can be immediately generalized to a continuum, whose particles are subject to gravitational and *non*-gravitational (e.g., electromagnetic) interactions. It is indeed sufficient to choose a *co-moving* reference frame – as it is always possible if the particle trajectories do not cross. Here too the metric tensor does not depend on the motion of the medium – motion that the metropolitan legend considers responsible of the emission of GW’s.

5. Fock [8] pretended erroneously that the so-called *harmonic frames* possess a *physical* privilege with respect to the other co-ordinate systems. Thus, in particular, all his computations concerning the GW’s are performed in a harmonic frame, and with mass tensors of *extended* bodies. Since the motions of gravitating *point* masses do not generate GW’s, it is difficult to believe in a thaumaturgical virtue of largeness. Indeed, the extended bodies are composed of particles, and, further, their translational motions are correctly treated as motions of material corpuscles.

Fock’s computations regarding the GW’s are rather poor in physical significance.

APPENDIX A

α) I report here the summary of a communication by I. Leonor at LIGO Scientific Collaboration meeting, March 23, 2005, entitled “Searching for GRB-GWB coincidence during LIGO science runs”.

Summary:

- developed scheme for searching for GRB-GWB coincidence in near real time
- looking forward to S5 run with ~ 100 GRB triggers in one year of coincident run
- performed search for short-duration GW bursts coincident with S4, S3, and S2 GRB’s using cross-correlation method
- sample probability distribution consistent with null hypothesis. –

The LIGO scholars are technically very clever, but evidently they cannot discover a non-existent object as a GW. They can only persevere in dissipating the money of the tax-payers. –

β) On *arXiv:gr-qc/0505029 v1* (6 May 2005) we can read a paper of 23 pages, written by 395 LIGO-researchers all over the world, entitled “Upper limits on gravitational wave bursts in LIGO’s second science run – LIGO-P040040-07-R”.

Here are some sentences from the ABSTRACT: “We perform a search for gravitational wave bursts using data from the second science run of the LIGO detectors, using a method based on a wavelet time-frequency decomposition. This search is sensitive to bursts of duration much less than a second and with frequency content in the 100-1100 Hz range. It features significant improvements in the instrument sensitivity and in the analysis pipeline with respect to the burst search previously reported by LIGO. [...] No gravitational wave signals were detected in 9.98 days of analyzed data. [...]”.

At p.11 we read: “The WaveBurst analysis applied to the S2 data yielded 16 coincidence events (at zero-lag). The application of the r -statistic cut rejected 15 of them, leaving us with a single event that passed all the analysis criteria.”. And at p.13: “The investigation revealed that the event occurred during a period of strongly elevated acoustic noise at Hanford lasting tens of seconds, as measured by microphones placed near the interferometers. [...] The source of the acoustic noise appears to have been an aircraft.” –

In spite of the repeated failures, the LIGO scientists are still hopeful. *Spes ultima dea.* –

γ) On *arXiv:gr-qc/0505042 v1* (10 May 2005) the above 395 scholars have published an article (7pp.) entitled “Search for Gravitational Waves from Primordial Black Hole Binary Coalescences in the Galactic Halo”. From the ABSTRACT: “We use data from the second science run of the LIGO gravitational-wave detectors to search for the gravitational waves from primordial black hole (PBH) binary coalescence with component masses in the range $0.2-1.0M_{\odot}$. [...] No inspiral signals were found.” – Obviously: both GW’s and BH’s are non-existent objects [9]. The so-called *observed* BH’s are enormously massive bodies restricted in relatively small volumes – as it can be demonstrated by a careful scrutiny of the concerned papers [10]. –

δ) Again the mentioned 395 scientists on *arXiv:gr-qc/0505041 v1* (12 May 2005): “Search for gravitational waves from galactic and extra-galactic binary neutron stars” (20pp.). From the ABSTRACT: “We use 373 hours (≈ 15 days) of data from the second science run of the LIGO gravitational-wave detectors to search for signals from binary neutron star coalescences within a maximum distance of about 1.5 Mpc, a volume of space which includes the Andromeda Galaxy and other galaxies of the Local Group of galaxies. [...] No inspiral gravitational wave events were identified in our search.” The conclusion of the paper is the following (p.19): “In this paper, we have presented a data analysis strategy that could lead to a detection of gravitational waves from binary neutron star inspirals. The methods used to validate the search illustrate the subtleties of the analysis of several detectors with different sensitivities and orientations. Moreover, the experience gained by following up the largest coincident triggers

will be crucial input to investigations of event candidates that are identified in future searches.” An Italian jest says: *Chi vive sperando muore cantando.* –

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- [3] See [1] and the pertinent literature quoted there, in particular: A. Loinger, *Nuovo Cimento B*, **115** (2000) 679; Idem, *Spacetime & Substance*, **3**, No.3(13), 2002, p.129; also in *On BH’s and GW’s, II* (La Goliardica Pavese, Pavia) 2005, p.52; also on *arXiv:physics/0202065 v1* (February 27th, 2002).
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- [6] L. Landau et E. Lifchitz, *Théorie du Champ* (Éditions Mir, Moscou) 1966, sect.99.
- [7] Cf. e.g. E. Lifchitz and I. Khalatnikov, *Advances in Physics* **12** (1963) 185.
- [8] V. Fock, *The Theory of Space, Time and Gravitation* (Pergamon Press, Oxford, etc.) 1964, *passim*.
- [9] See e.g. A. Loinger, *arXiv:physics/0402088 v1* (February 18th, 2004); Idem, *On BH’s and GW’s, II* (La Goliardica Pavese, Pavia) 2005, pp.13, 17, 26, 30, 35. The first proof that the notion of BH is a nonsense was given by K. Schwarzschild, *Berl. Ber.*, (1916) 189; for an English translation of this fundamental memoir see: *arXiv:physics/9905030* (May 12th, 1999), and *Gen. Rel. Grav.*, **35** (2003) 951; also in *On Black Holes and Gravitational Waves* (La Goliardica Pavese, Pavia) 2002, p.107;
- [10] See in particular A. Loinger and T. Marsico, *arXiv:astro-ph/0305036 v1* (March 9th, 2003), and *Spacetime & Substance*, **4**, No.2(17), 2003, p.80; also in *On BH’s and GW’s, II* (La Goliardica Pavese, Pavia) 2005, p.17.

SPACE-TIMES WITH DISCRETE AXIAL AND MIRROR SYMMETRIES

Claude Gauthier ¹▲, Cory Walker ²◆,

▲ *Département de mathématiques et de statistique, Université de Moncton, Moncton, N.-B., Canada E1A 3E9*

◆ *Département de physique et d'astronomie, Université de Moncton, Moncton, N.-B., Canada E1A 3E9*

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We find a condition which applies to the metric of every space-time whose spatial sections are invariant under a discrete axial symmetry of order $N > 2$ and two mirror symmetries. It follows that, according to general relativity, no non-cylindrical object having these symmetries can exist. This result leads to new contradictions between predictions of quantum theories and general relativity.

1. Introduction

To solve Einstein's equations, people working in general relativity often introduce simplifications which mean they have to look for space-times with special symmetries. These symmetries are usually assumed to be continuous. Little importance is given to discrete symmetries in the extensive literature devoted to space-times with symmetry properties [1]. However, the analysis of discrete symmetries may yield amazing results. For instance, using the discrete symmetry associated with the multiconnectivity of a flat or a spherical three-dimensional space, we have shown in [2] that such spaces correspond to physically unrealistic space-times. Therefore, if the universe has flat or spherical spatial sections, then these sections must be simply connected. Another application of discrete symmetries in general relativity is based on the symmetries of one or the other of the five Platonic solids. It is shown in [3] that every space-time whose spatial sections satisfy the symmetries of any of these solids must have an empty center of symmetry. Therefore, according to general relativity, the molecule of methane CH_4 which has the tetrahedral symmetry in its ground state should have nothing at its center of symmetry. But this contradicts quantum mechanics which asserts that this region is occupied by the atom of carbon.

In this paper, we will determine a condition which applies to the metric of every space-time whose spatial sections are invariant under a discrete axial symmetry of order $N > 2$ and two mirror symmetries. These symmetry assumptions are weaker than those associated with the symmetries of the five Platonic solids used in [3]. We will show that general relativity forbids the

existence of any non-cylindrical object having these discrete axial and mirror symmetries. We will see that this result implies new contradictions between general relativity and quantum theories.

2. Discrete axial and mirror symmetries

Let us first explain what we mean by a discrete axial symmetry for the spatial sections of a space-time M_4 . The universe represented by M_4 is assumed to contain a privileged observer O whose world-line is a time-like geodesic γ . The observer O separates M_4 into space and time by referring to the three-dimensional set S_3 of all geodesics at O normal to γ as space, and to some suitably chosen parameter t defining his or her position on γ as time. The universe will be said to have a discrete axial symmetry of order N if at any instant there exists in S_3 a privileged geodesic γ^* passing through O which is such that at any point of it, all directions normal to γ^* and corresponding to an integer multiple of $2\pi/N$ in S_3 are intrinsically indistinguishable.

To mathematically translate the property of discrete axial symmetry for the spatial sections of M_4 , we introduce a system of coordinates on M_4 . Let x^α , $\alpha = 0, 1, 2, 3$, be a coordinate system such that the spatial sections of M_4 are described by $x^0 = \text{constant}$. We also consider a change of coordinate system for M_4 and designate by \bar{x}^α , $\alpha = 0, 1, 2, 3$, the new coordinate system. Since we are interested only in transformations of the spatial sections of M_4 , we can assume that the above change of coordinates system leaves invariant the time coordinate x^0 . In a tubular neighborhood around the geodesic γ^* , the discrete axial symmetry is described as the set of transformations of the three-

¹E-mail: gauthic@umoncton.ca

²E-mail: ecw@umoncton.ca

dimensional Euclidean space E_3 which are orthogonal and unimodular. Without loss of generality, we can assume that the privileged geodesic γ^* coincides with the x^3 -axis of E_3 .

We now consider the two mirror symmetries for the spatial sections of M_4 . Using the above coordinate system on M_4 , we can assume that these mirror symmetries are one with respect to the plane $x^1 = 0$, and the other with respect to the plane $x^3 = 0$. Under these mirror symmetries, the coordinates of any point of M_4 transform as

$$(\bar{x}^0, \bar{x}^1, \bar{x}^2, \bar{x}^3)^T = A (x^0, x^1, x^2, x^3)^T,$$

where A is given by $A_1 = \text{diag}(1, -1, 1, 1)$, or $A_3 = \text{diag}(1, 1, 1, -1)$, according as the mirror symmetry is with respect to the plane $x^1 = 0$, or to the plane $x^3 = 0$.

3. Curvature tensor

We now determine a condition which applies to the curvature tensor of every space-time M_4 whose spatial sections have a discrete axial symmetry of order $N > 2$ and the two above mirror symmetries, one of which being with respect to a plane perpendicular to the axis of the discrete axial symmetry. If the spatial sections of M_4 have these symmetries, then its curvature tensor R is invariant under the same symmetries. Considering the mirror symmetry with respect to the plane $x^3 = 0$, and the fact that the x^3 -axis is the axis of the discrete axial symmetry, this means that R must be invariant, in particular, under any change of coordinates generated by the matrix (see [4])

$$\text{diag} \left[1, \begin{pmatrix} \cos(2\pi/N) & \sin(2\pi/N) \\ \sin(2\pi/N) & -\cos(2\pi/N) \end{pmatrix}, -1 \right].$$

This property is valid in a three-dimensional region V neighboring the plane $x^3 = 0$ and around the x^3 -axis. At any point in V , the 20 algebraically independent components of R will thus be invariant under the same transformations. This holds for the ten independent components of the Weyl tensor, and the ten independent components of the Ricci tensor.

We have shown in [5] that every M_4 whose spatial sections are mirror symmetric with respect to one plane has a Weyl tensor which vanishes identically in a three-dimensional region neighboring this plane. This result will thus hold in the region V . Consequently, the only algebraically independent components of the curvature tensor which are possibly non-zero in V are those forming the Ricci tensor.

To deduce conditions which apply to the Ricci tensor in V , when the spatial sections of M_4 are discrete axial and twice mirror symmetric, we first note that $(R_{\alpha\beta})$ can be seen as the matrix realization of a bilinear form defined in V . A given change of coordinate

system of M_4 then transforms $(R_{\alpha\beta})$ in V according to

$$(\bar{R}_{\alpha\beta}) = A(R_{\alpha\beta})A^T.$$

The invariance of $(R_{\alpha\beta})$ under such a transformation implying that $(\bar{R}_{\alpha\beta}) = (R_{\alpha\beta})$, we obtain

$$(R_{\alpha\beta}) = A(R_{\alpha\beta})A^T. \quad (1)$$

The substitution of A_1 and A_3 into (1) directly leads to

$$(R_{\alpha\beta}) = \begin{pmatrix} R_{00} & 0 & R_{02} & 0 \\ 0 & R_{11} & 0 & 0 \\ R_{02} & 0 & R_{22} & 0 \\ 0 & 0 & 0 & R_{33} \end{pmatrix}.$$

Now, taking into account the discrete axial symmetry of order $N > 2$ (see (30) of [4]), it follows that

$$(R_{\alpha\beta}) = \text{diag}(R_{00}, R_{11}, R_{11}, R_{33}). \quad (2)$$

4. Metric tensor

Since the Weyl tensor part of R is identically zero in V , we have that M_4 is conformally flat there, and thus that the metric line element can be written as

$$ds^2 = w^2 \eta_{\alpha\beta} dx^\alpha dx^\beta, \quad (3)$$

where $(\eta_{\alpha\beta}) = \text{diag}(1, -1, -1, -1)$ is the Minkowski metric and $w = w(x^0, x^1, x^2, x^3)$ is a non-zero twice differentiable function.

The results (2) and (3) will allow us to be more specific about the metric of M_4 in V . To this end, we begin by determining the explicit forms of ten algebraically independent components of the Ricci tensor associated with the metric (3). Using a computer algebra system, such as GRTensor for Maple [6], we find

$$\begin{aligned} R_{00} &= (-3w_{,00} + w_{,jj})w^{-1} \\ &\quad + (3w_{,0}^2 + w_{,j}w_{,j})w^{-2} \\ R_{(i)(i)} &= (w_{,00} - w_{,jj} - 2w_{,(i)(i)})w^{-1} \\ &\quad + (w_{,0}^2 - w_{,j}w_{,j} + 4w_{,(i)(i)})w^{-2} \end{aligned}$$

and

$$R_{\alpha\beta} = -2w_{,\alpha\beta}w^{-1} + 4w_{,\alpha}w_{,\beta}w^{-2}, \quad \alpha < \beta, \quad (4)$$

where the Latin indices take the values 1, 2, 3 and there is no sum on the indices enclosed within parentheses. We have also used the comma to denote ordinary differentiation.

According to equation (2), the six expressions of (4) become six equations whose common solution is

$$w = \left(\sum_{\gamma} X_{\gamma} \right)^{-1}, \quad (5)$$

where the $X_{\gamma} = X_{\gamma}(x^{\gamma})$ are arbitrary twice differentiable functions of only one coordinate each. Computing the independent components of the Ricci tensor of

a M_4 having the metric (3), with w given by (5), we find only four of them that are non-zero

$$R_{00} = \left(3X_0'' - \sum_j X_j'' \right) \left(\sum_\gamma X_\gamma \right)^{-1} - 3 \left((X_0')^2 - \sum_j (X_j')^2 \right) \left(\sum_\gamma X_\gamma \right)^{-2}$$

and

$$R_{(i)(i)} = \left(-X_0'' + \sum_j X_j'' + 2X_i'' \right) \left(\sum_\gamma X_\gamma \right)^{-1} + 3 \left((X_0')^2 - \sum_j (X_j')^2 \right) \left(\sum_\gamma X_\gamma \right)^{-2}. \quad (6)$$

Expression (2) shows that we must have $R_{11} = R_{22}$. From (6), we see that R_{11} and R_{22} differ only by the terms in X_1'' and X_2'' . It follows that there exists a constant a such that $X_i''(x^i) = a$ for $i = 1, 2$. Consequently

$$X_i(x^i) = ax^{(i)}x^{(i)} + b_{(i)}x^{(i)} + c_i, \quad i = 1, 2,$$

where the b_i and c_i are constants. By translating each of the spatial coordinate axes as necessary (these operations do not affect the differentials dx^i and thus the metric), we can always manage to write

$$X_i(x^i) = ax^{(i)}x^{(i)} + d_i, \quad i = 1, 2,$$

where the d_i are some constants. This means that the function w in (3) becomes

$$w(x^0, r, x^3) = [X_0(x^0) + X_3(x^3) + ar^2 + d]^{-1},$$

where d is a constant and $r = \sqrt{x^1x^1 + x^2x^2}$ is the spatial distance to the axis of the discrete axial symmetry.

5. Conclusion

Everywhere in the three-dimensional region V , the metric of the M_4 is, at every time x^0 , a function only of the spatial distance to the x^3 -axis. If the space-time considered is not cylindrically symmetric, then it is impossible for its metric to take into account any discrete axial symmetry around the x^3 -axis in the region V . Given that any material body requires a non-vanishing matter tensor, and thus a non-vanishing curvature tensor, we see that no non-cylindrical symmetric object can be created with a discrete axial symmetry of order $N > 2$ and two mirror symmetries of the kind considered here.

It is possible to relate the above result to the quark structure of certain baryons. Every baryon made up of

three identical quarks, such as the Δ^- particles, has indeed a discrete axial symmetry of order three and two mirror symmetries, one of the last symmetries being with respect to a plane perpendicular to the axis of discrete axial symmetry. We have seen that, according to general relativity, no such particle should exist. Of course, this result contradicts chromodynamics. Another example of contradictions between the above predictions of general relativity and theories which describe our universe at small scales is provided by the molecule of benzene C_6H_6 . According to quantum chemistry, this molecule has a discrete axial symmetry of order six and three mirror symmetries in its ground state. Again, according to general relativity, this kind of molecules should not exist.

As we pointed out in [3], the contradictions we have put forward are between theories used to model some aspects of physical reality. We did not show any contradiction between one of these theories and reality itself. Our results do not detract from their worth each of these theories in their domain of application. They only emphasize the fact that we cannot simultaneously apply a quantum theory and general relativity to the same domain without intrinsic contradictions.

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ABOUT EVOLUTION OF SYSTEMS OF THE BASIC UNITS OF MEASURE (PHYSICS)

I.M. Galitsky¹

Phon: +38 (0572) 94-98-51, Kharkiv, Ukraine

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The system of the basic units of measure is the base (“language”) on which all building of concepts, representations and terms of theoretical physics is under construction. Evolution of such force systems (physics) from initial ancient Greek up to new the quantum-relativistic, expressed in terms of the universal fundamental stationary values $[h]$ and $[c]$, with new productive corollaries leaking from here is shown. The solution of “a time problem” is ensured with an establishment of requirements of invariance of operation of macroclocks and quantum clocks as functions of energy-mass spent by them. Obtained other new results are given also.

There is one science – physics,
 the everything else are a collecting
 of marks.
 Ernest Rezerford

1. INTRODUCTION

It is known, that N.Bor in a basis of the model of atom formulated by him has offered a series of postulates which entered an explicit inconsistency with the physical principles conventional on that moment and laws (were explicitly “pseudoscientific”, “mad”).

Nobel winner Leon Cooper have estimated this situation in such a way::

“Certainly, to telescope propositions which contradict an electrodynamics of Maxwell and mechanics of Newton from N.Bora’s party was self-confident, but Bohr was young” [1, with. 136].

Surprises not that Bohr has offered such “mad” work (in fact “Bohr was young”!); surprises *how the journal has dared to publish such explicitly “pseudoscientific” work?* As appeared, the hazard of journal has been justified: N.Bora’s “mad” theory began one of establishing in becoming nuclear physics, a science.

Academician L.D.Landau of the most valuable of the work counted the theory of a superfluidity of helium, “because almost nobody understands it” [17].

Originally the electrodynamics of Maxwell was perceived by contemporaries as “the far-fetched theory” as “an interesting funny thing”, and the nickname “Booby” has been given to Maxwell [18].

(the History of a science testifies, that *almost all new revolutionary ideas, sciences in the beginning were*

perceived as “pseudoscientific” (“mad”), and their authors found reputation “pseudoscientific” (“lunatics”); for this reason frequent an against innovators of a science (“heretics”) were applied both prisons, and other shapes of prosecutions (fires and crosses), how many to that of examples! But it is a separate theme...).

Hence, an adolescence (on L.Kuper) is too argument! Especially it concerns those cases when *on the initial stage of becoming of new ideas* anything else to suggest it is impossible. The history of a science has convincingly confirmed it: in most cases new ideas are offered young, not burdened by a load of already developed dogmas and prejudices scientists. So, representatives of a young ancient Greek science: Platon, Aristotel, Zenon, Pifagor, Archimedes, Demokrit, Epikur, Anaksagor and others have put the bases of the modern science, having stated a series of ingenious ideas on an insight and prognoses, many of which have anticipated the subsequent discoveries, and some from them have not lost the urgency till now [2]:

— almost for 2000 up to Kopernik Aristarh Somossky stated, that “the Earth rotates around of the Sun, and the Sun lays at centre of its orbit.”;

— bases of a relativity principle are included in an aporia of Zenon Elejsky (III century up to AD) about three chariots;

— a probability theory in mathematics and the fundamental indeterminacy principle in physics are anticipated in the statement of Arkesilaj (III century up to AD) “to achieve terrain clearance true it is impossible, and necessary to be restricted to knowledge of that is probable”;

— The Greek mathematics has put in pawn bases of trigonometry and calculus; it started and has finished study of conics; Greeks have added geometries of three measuring such relative perfection, that after them it

¹E-mail: Galytsky@mail.ru

has not undergone changes on an extent almost 2000, down to Descartes and Pascal.

G.V. Lejbnitz: “Everyone who in a state to understand Archimedes, will admire with less discoveries of greatest of the modern people” [3, with. 171].

The atomistic hypothesis of Demokrit has thrown light on all fields of physics and chemistry.

Platon (IV century up to AD): “the laws driving a motion of the sky, it is finer than stars” [2].

This definition of Platon can serve as anticipation *just now to a developed* uniform field theory, in which stars is far from being the most important component of theory.

First “Physics” is too Aristotel!

Minus reachings technique, the majority of the modern concepts and definitions descend from ancient Greece [2]: philosophy, physics, geometry, biology, anatomy, astronomy, an electricity, atom, a charge, space, academy, school, university, politics, ethics, logic, ecology, a determinism, tyranny, despotism, corruption, bureaucracy, demagogu, etc., etc. *all this is the Greek words*. Many of these definitions further have underlain the whole scientific directions and disciplines, have not lost the urgency and now.

2. ABOUT EVOLUTION OF SYSTEMS OF THE BASIC UNITS OF MEASURE (PHYSICS)

Wise ancient Greeks also have noted, that all variety of appearances apparent in the nature can be reduced, ultimately, to some restricted quantity of “substances”, “atoms” with which help it is possible to describe, explain all “the nature of things” [2].

So, Anaksagor (V century up to AD) considered sufficient three “substances”:

The ground,
Water,
Heat,

whereas Demokrit (IV century up to AD) started with sufficiency of two “beginnings”:

Atoms,
Hollow.

In the modern interpretation it also is the first systems of the basic units of measure. To their deficiencies it is necessary to refer that they had rather blanket, intuitively — emotional character, *were not so concrete and physical* that on their basis it was possible to construct *actual physical etalons and devices* for realization of *concrete physical measuring*.

But in fact up to Galilei and Newton was about 2000!

(whether we Can be guaranteed *now* what *our advanced scientific estimates in 2000* will not be same incomplete how bible and ancient Greek — today? Hardly...).

However a doubtless virtue of ancient Greek *rather blanket* systems of the basic units of measure was that they explicitly contained a guess about necessity of existence of some initial “beginnings” underlying “all real” — *the deepest idea of simplicity of the nature*.

A. Einstein: “Laws of physics should be *prime*, differently they would not represent for me any interest” [4].

SH. Gleshou: “the Majority of physicists part unshakable belief in *establishing simplicity of the nature*. For us it is one of the most powerful supervising principles. Not time this *blind belief* appeared true” [5].

As it visual, this “*blind belief in establishing simplicity of the nature*” has arisen at ancient Greeks as “*one of the most powerful supervising principles*” about 2500 years ago; and this ancient principle of “*simplicity of the nature*” and now is a radiant of “*unshakable belief*” in a modern physics, a science.

At the given stage of development the physics will consist of three views of a mechanics.

1. A Newtonian mechanics, defined system of three basic units of measure: in mass, time and length

$$m_v = m_0, \quad (1)$$

$$t_v = t_0, \quad (2)$$

$$r_v = r_0, \quad (3)$$

with which help all classical (Newtonian) physics can be circumscribed.

As against units of Anaksagor and Demokrit of unit of measure of Newton are physically concrete and as consequence, are measurable. From formulas (1), (2), (3) follows also, that Newton of unit in moving and in based systems of coordinates are equal.

In a Newtonian mechanics duration (“time”) of course of processes can be measured, for example, in “grammas” of hourglasses (embodying of a principle $t = m_t$) or in “centimeters” (divisions) of a dial of mechanical clocks (embodying of a principle $t = r_t$) — thus invariance of the equations of a Newtonian mechanics is not broken [6].

2. The relativistic mechanics specifies the basic units of measure Newton of mechanics (1), (2), (3) Lorents amendments

$$m_v = \pm \frac{m_0}{\sqrt{1 - \beta^2}}, \quad (4)$$

$$t_v = \pm \frac{t_0}{\sqrt{1 - \beta^2}}, \quad (5)$$

$$r_v = \pm r_0 \sqrt{1 - \beta^2}, \quad (6)$$

which *invariance of formulas* (5) and (6) veto a principle $t = r_t$ in view of *not, leaving comprehensible only the principle $t = m_t$ in view of invariance of formulas* (4) and (5), that observationally proves to be true in

accelerators at a motion in them short-lived particles, the mass and which lifetime depending on velocity of a motion vary invariant [6, 7].

The consistency of a principle $t = m_t$ streams also from the experimental fact of impossibility of build-up of any clocks which would work without expenditures of mass — energy (glass, water clocks) or energy — mass (mechanical, electrical, atomic clocks): there are no “eternal clocks” = the “eternal” drive [5–7].

A.Einstein: “there Is no concept concerning which I would be sure, that it remain firm. I am even not sure, that I am on the exact trajectory” [8].

This point of view (“cry from the heart”) of the scientist which has brought in the huge contribution to becoming new physics and a science as a whole.

Than such severe pessimism is caused in Einstein?

The answer to this problem is given by Einstein, “... being grounded on anything the friend, except for belief in *simplicity and clearness of the nature*; the proposition is the following: ... the nature is arranged so, that its laws in the greater standard are defined *by only logic requirements* so, that expressions of these laws are entered only with the stationary values supposing theoretical definitions, that is such stationary values, that their numerical values cannot be changed, not breaking the theory” [9].

Einstein’s the deepest intuition appeared valid and in this case as in embodying this prognosis gives a principle $t = m_t$, permitting to express the basic units of measurements (physics) not in the arbitrary (subjective) unities (including in SI and CQS), and in true the universal fundamental stationary values $[h]$ and $[c]$ as [5, 6]:

$$m_v = \pm \frac{\left\{ \frac{m_0}{\sqrt{h/c}} \right\} \left[\frac{\sqrt{h}}{c} \right]}{\sqrt{1 - \beta^2}}, \quad (7)$$

$$t_v = \pm \frac{\left\{ \frac{t_0}{\sqrt{h/c}} \right\} \left[\frac{\sqrt{h}}{c} \right]}{\sqrt{1 - \beta^2}}, \quad (8)$$

$$r_v = \pm \left\{ \frac{r_0}{\sqrt{h}} \right\} \left[\sqrt{h} \right] \sqrt{1 - \beta^2}. \quad (9)$$

3. The quantum-relativistic system (7), (8), (9) basic units of measure (physics) is expressed in the universal fundamental unities $[h]$ and $[c]$, which (on Einstein) “are defined by only logic requirements”: h — a postulate (“the logic requirement”) about a constancy of quantum of activity ($h = \text{const}$); c — a postulate (“the logic requirement”) about a constancy of velocity of light ($c = \text{const}$).

Hence, the system of the basic units of measure (7), (8), (9) in the same standard is universal and fundamental (*is chosen*), in what are universal and fundamental (*are chosen*) h and c which those and are; in

this connection all existing *arbitrary (subjective) units of measure (including SI and CQS) should be invariant concerning the fundamental (chosen) force system* (7), (8), (9). The analysis of this problem given in operation [6], has shown, that system CQS requires updating on $\approx 3\%$, whereas system SI — on three order; for this parent all calculations are conducted in system CQS, invariance which (coherence) with a fundamental force system (7), (8), (9) at the given stage of viewing of a problem it is supposed sufficient.

Let’s specify the important argument: all given force systems of measuring (physicist): the Newtonian (1), (2), (3); the relativistic (4), (5), (6) and the fundamental universal quantum-relativistic (7), (8), (9) — *do not contradict “a principle of correspondence”* to N.Bor.

The known *Planck* system of the basic units of measure formed from three stationary values: velocities of light, a Dirac constant and a stationary value of gravitation, — is not the universal as contains the stationary value of gravitation restricting a scope of this system. The new quantum-relativistic force system of measuring (7), (8), has no such (9) restrictions, as is defined *only by the universal fundamental stationary values h and c* .

In this connection the following estimate is actual:

“... us energy, force, an impulse, an electrical charge, etc. accustom to view the nature in various aspects with the help of such quantities, as mass. It is important to remember, however, that *any of these quantities is never measured in physical experiments immediately*. It is necessary to understand rigidly, that *everything, that, ultimately, we measure in research experiments, are lengths spatial and gaps of time intervals*. We gain values of all remaining physical quantities only from effects of these last measuring” [1, with. 13].

The given definition reflects *essence* of existential concept GR. The principle $t = m_t$ allows to deepen these representations up to an opportunity to express also space — time in terms of (in “language”) $[h]$ and $[c]$.

So, for example, the second Newton’s laws

$$F = m \frac{d^2 x}{dt^2}. \quad (10)$$

In view of a principle $t = m_t$ it can *be consistent* it is noted as

$$F = m \frac{d^2 x}{dm_t^2}, \quad (11)$$

where m_t — mass time (for example, mass of sand flowing in hourglasses).

Hence, the principle $t = m_t$ guesses, except for known masses inertial, gravitational, the relativistic, given, etc. — to enter also mass time m_t .

Similarly to the formula (11) blanket Schrodinger equation in view of a principle $t = m_t$ can be consistent is noted as

$$-\frac{\hbar^2}{2m} \frac{\partial^2 \psi(x, m_t)}{\partial x^2} + u\psi(x, m_t) = i\hbar \frac{\partial \psi(x, m_t)}{\partial m_t}, \quad (12)$$

whereas stationary, “not dependent on time”, [1, with. 165] the Schrodinger equation looks like

$$\frac{d^2 \psi(x)}{dx^2} + \frac{2m}{\hbar^2} (E - U) \psi(x) = 0. \quad (13)$$

In terms of $[h]$ and $[c]$ under formulas (7), (8), (9) second Newton’s laws (11) will become

$$F_{h,c} = \left\{ \frac{mc}{\sqrt{h}} \right\} \left[\frac{\sqrt{h}}{c} \right] \frac{d^2 \left(\left\{ \frac{x}{\sqrt{h}} \right\} \left[\sqrt{h} \right] \right)}{d \left(\left\{ \frac{m_t c}{\sqrt{h}} \right\} \left[\frac{\sqrt{h}}{c} \right] \right)^2}. \quad (14)$$

Similarly to the formula (4), in terms of (in “language”) $[h]$ Maxwell equations, Dirac, Einstein, Schrodinger — all physics also $[c]$ can be written down; standardization of physics in terms of true the universal fundamental stationary values $[h]$ is carried out and $[c]$ — from physics an arbitrariness (“illusions” — on Einstein) as *all physical quantities become various combinations of stationary values h* is expelled and c . And it already “language” of the Nature. And only the principle $t = m_t$ allows to implement this opportunity without contradictions.

3. ABOUT THE SOLUTION OF “THE PROBLEM OF TIME”

“The problem of time” interested contributors during many centuries.

Let’s give *some* estimates [5]:

Aristotel (IV century up to AD): “Time is *a number of a motion*”.

Lukretsy of Penalties (I century up to. AD): “And inevitably to recognize, that as anything time in itself *outside of a motion of bodies and rest*” cannot be felt.

Avgustin (V AD): “... there is nothing *more not clearly and more secretly* and more causing on reflection, than time”.

A.D. Chernin: “Last and final *answer to a problem “that such time?” Does not exist*”.

I.L. Rosental: “*definition of “time” — a problem not absolutely prime* Is represented obvious, that”.

I.S. Shklovsky: “Can be, *the concept of “time” completely will lose the usual sense*”.

R. Fejnman: “*Time is one of concepts, to spot which it is impossible*”.

I.R. Prigozhin: “*Time — the most inconsistent category of physics. The problem of time always was unapproachably difficult. The problem of time challenges*

also to us [11]. *Even Einstein counted a directedness of time, and time, illusion, ... the time directedness arises then when we is artificial we introduce time in the unlimited Universe.* [13]. The greatest surprise calls that the solution of a secular problem — a clock paradox gives the solution and other problems of a modern physics. [12]. *Time is a key to understanding of the nature*” [11].

R. Penrouz: “... our modern pattern of a physical reality, *especially in that, as to the nature of time, — is fraught with the strongest shock*, even more the strong, than what was caused with a theory of relativity and a quantum mechanics in their modern shape” [12].

V.L. Ginzburg: “the Future theory ..., maybe, new also will bring, but what exactly, I do not present (*under suspicion — concept of time of a quantum mechanics*)” [16, with. 18].

Aristotel (IV century up to AD): “*That time does not exist at all*, being something not clear, it is possible to assume on the basis of the following. One part of it *was, and she already is not present*, another — *will be, and she still is not present. And that is composed from nonexistent, cannot be involved in existence*” [14, with. 64].

Offered ≈ 2500 years to that Aristotel *the logic* solution of “a problem of time” *at the modern level of a science* is formulated by I.R. Prigozhin in the following view:

“Reversibility of laws of dynamics, no less than laws of both fundamental sciences created in XX century, — a quantum mechanics and a theory of relativity, — *expresses such radical refusing time what could not imagine any culture, any collective knowledge*” [15].

Above mentioned two formulations: *logic* (Aristotel) and *natural-science* (Prigozhin) — “*problems of time*” — *in his (“time”) denying are different under the shape, but equivalent in essence in the solution.*

In a practical metrology there was a paradoxical situation: if in system of the basic units of measure for mass units and lengths exist etalons = samples as the weight of 1 kg for mass and a core of 1 m for the length, stored in Sevr (France), — that *of the etalon = the sample for unity of “time” of 1 second (it is similar to the weight and a core) — in the nature does not exist* [27].

Whether so there is such *basic unit of measure, how “time” for which there is no actual etalon = a sample?*

Whether there is *what actually is not present?*

As (on definition) “time flows *continuously and unidirectional* from the past in the future” (“a deflection of time”), — that how “*continuously flows time*” in hourglasses *after exhaustion in them masses of sand?*

How “time” in mechanical clocks *after exhaustion in them energy of the got spring continuously flows?*

How “time” in any clocks when they do not work *continuously flows (cost)?*

Whether there are the clocks showing “*the continuous fluxion of time*” without expenditures of energy

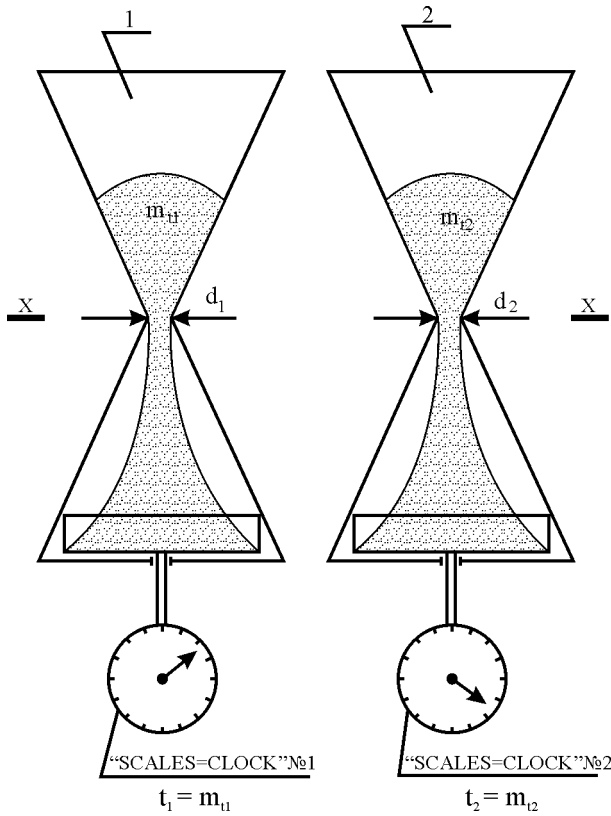


Figure 1:

— mass (mechanical) or masses — energies (glass) — “eternal” clocks = the “eternal” drive?

A. Einstein: “For us, the convinced physicists, distinction between the past, present and the future — only *illusion*, though also rather proof” [19, with. 42].

Whether is, in connection with enunciated above, “time” the same *idealization of the validity* (“*illusion*” — on Einstein) what was “flogiston” = “teplorod” in thermodynamics?

If it so “time” does not flow the same as does not flow “flogiston” = “teplorod”: only mass — energy or energy — mass — and anything else everywhere flows; hence, “a deflection of time” essence “a deflection of energy — mass”.

Consistent principle $t = m_t$ and corollaries leaking from him [5–7] — above mentioned “paradoxes” (Prigozhin), “illusions” (Einstein) and eliminate inconsistencies as *this principle is one of varieties of the fundamental law of conservation of energy of mass*.

In applied figure balance = clocks” N1 and N2 which are synchronized so are shown glass “, that at an overflowing of masses of sand from the upper flasks 1 and 2 in the inferior *one division* into dials “weights = clocks” N1 and N2 *correspond 1 g sand and 1 from duration of his course*:

Or

$$\left. \begin{aligned} (m_t = 1g_t) &= (t = 1s) \\ (t = m_t) &= (1s = 1g_t) \end{aligned} \right\} \quad (15)$$

In the given case (15) there is no expedient to prove preferability of one of the following two statements:

- The train goes with velocity of 5 meters for a second (effusing);
- The train goes with velocity of 5 meters for gramme (effusing);

As both these statements *are equivalent*.

Let’s accept “balance = clocks” N1 as reference, and “balance = clocks” N2 — as derivatives.

Let’s analyze some possible variants of their operation.

a) We shall accept the following starting conditions (on fig. 1):

$$d_2 = d_1; \quad m_{t2} = m_{t1}, \quad (16)$$

or in view of a requirement (16)

$$(m_{t2} = m_{t1}) = (t_2 = t_1) = (n_2 = n_1), \quad (17)$$

where n_2, n_1 — observations of number of divisions on “weights = clocks” N2 and N1;

Expression (17) can be copied as

$$(m_{t2} = t_2) = (m_{t1} = t_1) = (n_2 = n_1), \quad (18)$$

testifying to that after the effluxion “masses = time” sand from the upper flasks of 1 and 2 observations of arrows on dials “weights = clocks” N2 and N1 will be identical, testifying to their synchronous operation.

b) We shall accept other starting conditions (on fig. 1):

$$d_2 > d_1; \quad m_{t2} > m_{t1}, \quad (19)$$

whence

$$(m_{t2} > t_2) = (m_{t1} > t_1) = (n_2 > n_1), \quad (20)$$

or

$$(m_{t2} = t_2 = n_2) > (m_{t1} = t_1 = n_1), \quad (21)$$

testifying to that “balance = clocks” N2 *hasten* be relative “weights = clocks” N1 as after *synchronous starting* both “weights = clocks” *it will be always observed* $n_2 > n_1$ down to their stopping (according to requirements (19)); in a viewed case starting conditions can be selected in such a manner that will provide *synchronous operation* “weights = clocks” N1 and N2 *on frequency* $\nu_1 = \nu_2$ *of their tumbles on 180° around axis x-x* that can be noted as

$$(t_2 = m_{t2} = n_2) > (t_1 = m_{t1} = n_1), \quad (23)$$

$$\nu_1 = \nu_2. \quad (24)$$

Relations (23), (24) ensure *synchronous operation*, for example, a small watch and major tower clocks in which the power consumption of mass on demonstrating of fluxion of same “time” — *is essentially various*.

For frequency ν_x the principle $t = m_t$ is applicable as:

$$\begin{aligned} \{\nu_x\} [t]^{-1} &= \\ &= \{\nu_x\} [t = m_t]^{-1} = \\ &= \{\nu_x = 0; 1; 2; \dots\} [(t = m_t) = (1s = 1g_t)]^{-1}. \end{aligned}$$

Let's consider an example of quantum clocks which operation is featured by the quantum-relativistic equation

$$m_x c^2 = h \nu_x, \quad (25)$$

featuring an appearance of an annihilation of mass m_x in electromagnetic radiation by frequency ν_x .

Let's copy the equation (25) as

$$m_x = \frac{h}{c^2} (\nu_x = 1) \approx 10^{-47} g = \text{const} = m_{h,c}, \quad (26)$$

where $m_{h,c} \approx 10^{-47} g$ is considered as *mass quantum* “grain of sand”, the relevant mass of one quantum (as in the formula (26) $\nu_x = 1$).

The formula (25) with the account (26) can be noted as

$$m_x = [m_{h,c} \approx 10^{-47} g] \cdot \{\nu_x = 0; 1; 2; \dots\}. \quad (27)$$

In the formula of “time” (27) *parameter misses*: it contains *the dimensional parameter as quantum of mass* $[m_{h,c}]$ and *the dimensionless series of natural numbers* $\{\nu_x\}$ — from a requirement of quantization.

The quantum-relativistic formulas (25), (26), (27), featuring operation of quantum clocks, — testify to existence in the quantum world of *the strong communication between mass and frequency as*

$$m_x \equiv f(\nu_x), \quad (28)$$

as in the quantum world quantum clocks are quantum objects.

Therefore, according to formulas (25), (26), (27), (28), — *build-up of two quantum clocks which would work* similarly “to macroclocks = to weights” N2 and N1 on item “c” where *at different rates of flux of masses is in essence impossible*

$$\left. \begin{aligned} m_{t2} &> m_{t1} \\ \nu_2 &= \nu_1 \end{aligned} \right\}, \quad (29)$$

Equal frequency of their operation, the formula (23), (24) is ensured.

In the quantum world quantum clocks go only under formulas (27), (28).

In this connection, *invariance of operation of quantum clocks* (27), (28) and *macroclocks* (29) can be realized *only by unification (selection) of parameters of macroclocks concerning parameters of quantum clocks, rather the reverse*.

Such *unified macroclocks* (for example glass) should correspond to the following requirements:

1) All grain of sand in mass m_Δ should be identical (similarly quantum “grain of sand” under the formula (26));

2) The overflowing of sand from the upper flask of hourglasses in inferior should happen *only on one grain of sand* (as in quantum clocks under formulas (27), (28));

3) Thus *any mass* of sand m_x should flow from the upper flask in inferior *with the frequency proportional to mass of sand* under the formula

$$m_x = [m_\Delta = \text{const}] \{\nu_x = 0; 1; 2; \dots\}, \quad (30)$$

whence

$$m_x = f(\nu_x). \quad (31)$$

Hence, *formulas (30), (31) for macroclocks and the formula (27), (28) for quantum clocks — are invariant*, that testifies to *synchronous operation of clocks*, as it was required to show.

The above mentioned analysis also excludes the bound with “time” of an inconsistency, “paradoxes” (Prigozhin) and “illusions” (Einstein).

4. PROGNoses AND THEIR EXPERIMENTAL ACKNOWLEDGEMENT

R. Fejnman: “Assigning of a science in its ability to foresee” [20].

During the solution of “a problem of time” a series of new corollaries (“previsions” is obtained — on Feynman), a part from which has already received the experimental acknowledgement, others require experimental checkout [5–7].

Let's give some from them.

1. The opportunity to express physics not in *the arbitrary (subjective)* basic units of measure is obtained (including, for example, in CQS and SI), and in terms of (in “language”) is true the universal fundamental Dirac constants and velocity of light, the formula (7), (8), (9).

An *arbitrariness* is excluded from physics: she is translated on *natural “language” of the nature — in terms of [h] and [c]*.

2. In 1992 [5], it is obtained the complete series of views of interactions (known and expected) and the complete series of stable fermions relevant to them (also known and expected), — among which *predicted two*

new views of interaction have received the experimental acknowledgement: neutrino and over gravitational (“dark energy”) intensities, accordingly, $\approx 10^{-26}$ and 10^{-52} unities of the strong [5–7, 28, 29].

3. Not found out in experience huge on gauges of a microcosm the Planck mass $\approx 10^{-5}$ g is improved up to $\approx 10^{-43}$ g, than and the fact of its lack as *poor precision of experiments at the given stage* does not allow to measure quantity $\approx 10^{-43}$ of [5, 6] speaks.

4. It is underlined necessity of existence at quantum objects (fundamental particles) *of new quantum mechanical effect of masses — oscillations* which, for example, for a proton and an electron should make, accordingly $\approx 10^{24}$ Hz and 10^{27} Hz. (for a proton this effect can be tested already at existing experimental opportunities) [5, 6].

5. Spatial structure (sizes) of an electron should be exhibited on length 10^{-17} of sm (experience on length 10^{-16} of sm have shown, that the electron has no structure) [5, 6].

6. “The Nature of mass — *one of the major unsolved problems of a modern physics*” [21].

Backgrounds of an establishment of the nature of mass also are obtained in terms of h and c [6].

7. A. Einstein: “I do not believe, that the God has created the nature such, that in it velocity of light on anything does not depend” [24].

Substantiations of a postulate about a constancy of velocity of light $c = \text{const}$ and a postulate about a constancy of quantum of activity $h = \text{const}$ are given [5, 6].

8. The problem of charging asymmetry of the Universe (“substance” — “antimatter”), viewed as quantum object (“a black hole”) and, as a corollary, possessing by effect of masses — oscillations in coordinates “substance” — “antimatter” is solved; *at the given stage of development the Universe is in a phase “substance”* [5–7].

9. E. Vigner: “we cannot know the bases on which *mathematical formulas are compounded with the physical world*” [22].

Similarly this problem was estimated by A. Puankare, D. Gilbert, A. Einstein, M. Born, P. Betru, B. Kolmar, D. Strajk, Bourbaki, JU.I. Manin and other contributors [5, 6].

Substantiations *of the physical nature of mathematics (physmatics)* also are given in terms of h and c , *than is excluded abstractedness mathematics* [5, 6].

Similarly to “flogiston” = “teplorod” and “time”, *abstractedness mathematics (and not only!) — one of the most major errors of a science.*

Platon (IV century up to AD): “*the Reality is proper also in abstraction*” [2].

D. Gilbert: “Never any problem excited so deeply human mind, as *a problem of perpetuity*” [3].

This problem also is successfully solved *as a special case* of the solution of more blanket problem — *a phys-*

ical substantiation of all mathematics (physmatics) [5, 6].

Are predicted (“will be foreseen” — on R. Fejnmamu) also other new effects [5–7].

5. DEDUCTIONS

Lui de Brojl: “*the Physics urgently requires new ideas and fashions which can arise only at revision of principles and the concepts laying in its bottom*” [5].

V.L. Ginzburg: “already primely it is impossible to find a little informed physics which would not see incompleteness and lack of isolation of the fundamental theory, ... *the new physics is unconditionally necessary both in physics and in astronomy*” [8].

The offered new trajectory creates backgrounds for performance of above mentioned programs: provides “*revision of principles and the concepts underlying physics*” (de Brojl), *an arbitrariness and “illusions”* (Einstein), and also “*eliminates from physics incompleteness and open condition the fundamental theory*”. (V.L. Ginzburg) [5–7].

L.D. Landau: “*Any guess can be justified by corollaries* leaking from him” [17].

D.I. Mendeleyev’s *guess* of necessity of existence of communication between properties of chemical elements has allowed it to create the table of devices, *a corollary* of that appeared possible *to predict* a series of the new chemical elements unclosed further in experiments.

Similar (Mendelev) a method has been used by M.Gell-Mannom at the systematics of fundamental particles based on *the guess* of existence of rather exotic quarks, also allowed *to predict* the new particles which have been found out further by practical consideration.

The offered principle of the solution “problems of time” also allows to establish dependence of masses of the complete lines of stable fermions (known and *expected*) and the intensities of the complete lines of views of interactions relevant to it (also known and *expected*), two of which (*expected*): neutrino with intensity $\approx 10^{-26}$ and over gravitational (“dark energy”) intensity $\approx 10^{-52}$ of unities of the strong [5–7], — *have received acknowledgement in experiments* [28, 29].

A. Einstein: “the Theory deserves that the greater trust, than *it is easier* than its parcel, than she has a *major scope* and than *more various phenomena* which she unites” [23].

The consistent principle $t = m_t$ meets all these requirements: *it is extremely prime*; has a *general scope*: parameters of “mass” and “time” — universal; *unites completely various concepts on the modern representations* — “mass” and “time.”

P.L. Kapitsa: “the Presence of any new appearance in the nature should be estimated *the more considerable, than it is more than changes can demand from*

sights existing at present and theories ... In a science we invariable apparent: *the discovery is more fundamental, the easier it can be formulated*” [24].

Examples:

The classical (Newtonian) mechanics is based on *the elementary principle* of equality of activity and counteraction

$$\vec{F}_1 = -\vec{F}_2;$$

The thermodynamics is based on *the elementary principle* of equivalence of thermal and mechanical operation

$$Q = A;$$

The electrodynamics is based on *the elementary principle* of an electromagnetic induction

$$E_{ind.} = -\frac{\Delta\Phi}{\Delta t};$$

The quantum mechanics is based on *the elementary principle* of a constancy of quantum of activity

$$h = const;$$

The special theory of relativity is based on *the elementary principle* of a constancy of velocity of light

$$c = const;$$

The general theory of relativity is based on *the elementary principle* of equivalence of gravitational and inertial masses

$$m_g = m_a;$$

Viewed *elementary principle* of equivalence of “time” and “masses”

$$t = m_t.$$

Also can appear fruitful: for this purpose already there are weighty backgrounds [5–7].

J.A. Smorodinsky: “we till now speak: “warmly flows”, “warmly flows”, — though *we know, that any “flogiston” = “teplorod” to which should flow, no*. Language frequently remembers that people *for a long time have overlooked*” [26].

Same can take place with “time”: it analog of a word “becomes warm”, *which actually is not present*.

D.A. Uiller: “For certain there will occur day when we shall see, that the principles underlying all real, are *so obvious and so fine*, that all of us shall be surprised, speak each other: as happened, that we so much time were blind!!!”. [25].

To this definitely answers “*so obvious and so fine*” (on D.A. Uiller) a principle $t = m_t$ with all *productive corollaries* leaking from him [5–7].

But it should be already: both new physics, and a new astrophysics, and new mathematics (Phismatic), and a new science as a whole [5–7].

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PRESENTATION OF THE WORLD UNIFIED PHYSICS

K.E. Putro¹

Kharkiv, Ukraine

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Philosophical and methodological reasonings on the World Unified Physics

The excursus into the physics formation history is required for verification of contemporary physics trustworthiness. As early as 1881 physicists were sure in the fact that the whole outer space is filled with the special material, which was called as ether. Let's call it as space material for convenience. It was considered that the world ether was absolutely immobile and all celestial objects moved in it without difficulty and, mainly, continuously. A. Michelson's experience was conducted for this hypothesis confirmation. Everybody expected that the light beam emitted by the interferometer, mounted on the planet surface in the direction of the Earth orbital motion round the Sun, will move with greater speed, than in perpendicular direction to its motion. But measurements showed that it moved with identical speed at any interferometer orientation in space. They gave this fact ordinary and radical explanation. If the light moving speed in circumterrestrial space remains unchanging at any interferometer orientation, so there is no ether in the world, including immobile. The generated emptiness after the outer space release from ether was called as the physical vacuum. Therein lies the modern calculation model of the world formation.

The conclusions rigidity and peremptoriness of the new formation radical physicists generated the doubting of the conservatives inclined to thoughts and analysis in the drawn conclusion correctness. The matter is that the similar result can be obtained at certain circumstances in ground variant of this experience execution and at the ether available. Let's assume that circumterrestrial space is filled with mechanical ether. If the dense material of the mechanical ether proves to be linked inseparably to the planet body, so the Earth will represent the single formation together with its personal material of circumterrestrial space. In such a case homogeneous dense material will appear immobile in relation to the planet surface along the whole volume of circumterrestrial space. The material of circumterrestrial space will be allowed moving synchronously with the planet body round the Sun in the same dense material of near-sun space. Therefore, the Earth orbital

motion process will be carried out not at the planet surface, but on the homogeneous materials joint of the circumterrestrial and near-sun space. It is possible to measure the Earth orbital motion rate by the interferometer only after its stabilizing on a geostationary orbit at the material periphery of circumterrestrial space, where it adjoins with such a dense material of near-sun space. It will be required to conduct the second part of A. Michelson's experience on the orbital station for this purpose, that is not done until now, unfortunately.

What result will we obtain in the first ground part of A. Michelson's experience conducting, when the interferometer appears to be surrounded by immobile material of the identical dense circumterrestrial space from all sides? We must obtain the same result exactly in this case as the result got actually. And quite not because there is no mechanical ether in the circumterrestrial space, but because it, possessing identical dense, is absolutely immobile relatively the planet surface which an interferometer is mounted on. So what does the circumterrestrial space consist, actually, - of the mechanical ether or physical vacuum?

The first part of A. Michelson's experience did not give, - and could not give, the single meaning answer to the main natural science problem.

The second part of it, which must give an answer to this question, is not conducted yet. Naturally, any model of the world construction has the right for consideration in the period of forced expectation, which will not contradict the result of this experience first part. The proposed model possesses the same right, the essence of which consists of the following.

The whole outer space is filled with mechanical ether, - special ideally transparent maximum dense material. The whole dense material of the world space is allotted completely between the objects existing in the world proportionally to the matters amount in each of them, - exactly proportionally to the matter amount, but not the objects mass. The whole dense material of the space is coupled tightly with its personal object and synchronously moves together with it.

This model differs substantially from the model de-

¹E-mail: putro1@mail.ru

veloped by G.Hertz, in which the outer space is filled with immobile permeable ether. Celestial objects are accompanied only by a little part of ether, which they succeed to extract in the motion process from the volume of immobile world ether.

No "non-privatized" space areas can exist in the proposed model unlike G.Hertz' model, non-inhabited by celestial objects with the appropriate matter content. And it means that in all observed vast areas of outer space, non-inhabited by stars, the invisible dark objects dwell, the bodies of which radiate only in infrared spectrum. The matter amount in them is proportional to the space volume, which is connected with them on the personal space rights. The orbital telescope of WMAP discovered these exotic, enigmatic objects. They were given the abstract name that does not reflect physical essence of the discovered objects, - "formation of dark (and darker) matter".

Inviolable connection of the space personal material with the object body is possible only at one necessary condition: the space material durability must be equal to the matter durability, which the object body consists of. Then the hard composition of the circumterrestrial space material with the planet body won't enable it to intermix with the same material of the near-sun space connected to the Sun body. It will allow possessing the space personal material for the Earth as well as the Sun. The volume of the space personal material of these two objects will be defined with the matter amount, contained in their bodies. The ideal transparency of space material excludes the possibility of the boundary optical observation between the circumterrestrial and near-sun space.

The transverse character of the light motion in space tells about the space material mechanical durability. Such motion is possible only in the case if the space material durability is equal to absolutely solid body durability. Exactly the strange method of light moving afforded ground for asserting that the ether is the mechanical ether. But they refused the development of the mechanical ether physical theory, as the mechanical ether contradicted observations as they consider. Then, as well as nowadays, they assumed that celestial bodies move continuously and freely in space. Unimpeded continuous motion of objects in the space dense material, and moreover their inertial motion, is impossible indeed. But only such method of objects motion is impossible, instead of their moving possibility in the space dense material. They gave up the mechanical ether grounding upon this doubtful foundation, substituting it by the permeable ether, which does not hinder to the continuous objects motion.

The cinema was not invented at that time yet, and physicists unsuspected even the possibility of the continuous motion illusion imitation consisting, actually, of the objects separate instantaneous jumps. The particles quantum motion had already been discovered then.

Without excepting the nature demonstrates the "cinema", aiming to present the celestial bodies quantum moving like their continuous motion, especially as no experiments and observations will be able either to confirm or refute this fact. Such reflections allow to reanimate the mechanical ether hastily rejected by science only on that foundation, that the celestial bodies motion in space is perceived by us as continuous and freely. We can get an answer as for the whole bulk of global problems only after the result obtaining of A. Michelson's experience second part.

If an orbital interferometer finds out the Earth's motion rate round the Sun at periphery of the circumterrestrial space, so the mechanical ether will become the alive burying victim of science, and the continuous unimpeded motion visibility of all objects in space, including celestial bodies motion, will be as wonderful illusion. If the orbital interferometer discovers no Earth's motion round the Sun there, so the physical vacuum ravaged the whole world space indeed, and unimpeded continuous motion in space will gain the status of the strictly definite scientific fact.

The choice between ether and physical vacuum can be executed only by the opened voting method regarding majority voices before this result obtaining that was done actually. But the democratic variant of the truth definition in science is unacceptable, as it does not guarantee the choice rightness.

But even the choice incorrectness of the world construction model does not deprive the physical vacuum of its indisputable attractiveness. The physical vacuum is much preferable in comparison with permeable ether, and moreover the mechanical ether. It excludes the necessity of the ether physical theory development. As well it is not necessary to explain the society the human life possibility in the conditions of space dense material with the comfort, that a man uses now, and moving in it freely without visible efforts. We have the right to use legally the ordinary mechanism of continuous unimpeded motion coming to us from the depth of ages in the conditions of physical vacuum at the motion description.

The idea of physical vacuum appeared not only attractive but also productive enough. It allowed the radicals to do quite logical far going conclusions. If, the measuring device, they reasoned, did not register the increase of the light beam speed in the direction of the Earth's orbital motion, so the light velocity does not depend on its source motion rate.

And it means, they concluded, the light velocity is permanent. It is extreme as for its value, and not a single world object can exceed the light velocity.

But they went beyond. If there is no immobile ether in the world, they proved, so there can not be the immobile reference system in it, which all objects move relatively. Therefore, every motion in the world is relative, they asserted.

These two quite logical conclusions made the world model with the physical vacuum to be perfect. Another physics was developed on this basis that became contemporary physics after some clarifications. It, having no inner contradictions, is brought to perfection nowadays, and it is senseless trying to discover some defects in it. A single lack of the existing physics is its application field limitation. Contemporary physics is intended only for the world, the space of which is the physical vacuum. The existing physics is absolutely unsuitable for the world with mechanical ether, in spite of its total perfection. Contemporary physics is incompatible with mechanical ether because the method of the objects continuous inertial motion in the space dense material is impossible in the resisting medium. Other physics will be required for the world with the space dense material that will explain the physical mechanism of the objects inertial motion in the medium unsuitable for this purpose.

In course of time the researchers began to find out facts, prejudicing the fundamentals, on which contemporary physics was based. The birth cases of the energy clots by the physical vacuum were registered, that must not be on determination.

The physical vacuum existence is prejudiced.

The gas cloud, appeared after the explosion of Super Nova, was found out, the size of which increased with speed, exceeding the light velocity. It contradicts the postulate, according which not a single object can move with the speed, exceeding the light velocity.

The light beam, the speed of which was less than the light standard velocity, was registered. It contradicts the assertion about the light velocity constancy.

And, finally, the observations, executed on the mentioned orbital telescope, showed that luminous stars are only 4% of the world objects total amount. The other 96% of world objects are presented as invisible dark and darker objects, about existence of which contemporary physics did not even presuppose. They develop according to other physics laws. And this means that contemporary physics in the form it exists nowadays doesn't conform to the real world, in which we live.

About the invisible dark objects existence in the world with detailed description of their physical properties was reported in the book "BIBLE about the WORLD and MAN", published before the observation results of the orbital telescope WMAP. It is placed on the site: www.putro1.narod.ru. The predictions of the dark objects existence were done on the new physics basis, stated in this book. It is developed for the world, the space of which is the mechanical ether. This physics is not only suitable for the world with the physical vacuum, but also unacceptable, and even it is absolutely unclear for physicists. It is quite reasonable, as there is the unknown mechanism description of the objects motion in the space dense material (mechanical ether), it is known almost nothing about physical properties of

which.

The situation with the substance isn't better. In spite of the fact that the term "matter" is sometimes used in physics, the description of its physical properties is given nowhere. There is no such a description in philosophy as well. It is known only, that all particles and macrobodies consist of the same matter that actually unites them. They determine any object feature regarding its mass that increases as far as its movement rate grows, while the substance amount remains unchanging in it. Namely this object-unchanging feature is required for its motion description in the space dense material. There are no methods of the substance amount determination in the object body regarding its mass in physics. There are no of them in philosophy as well. There are no measuring devices in practice also, that would allow defining the substance amount in object. Therefore, we actually know nothing either about physical properties of the space dense material or about the substance physical properties. These inconveniences create the necessity of new physics development from the "very beginning". But they compensate by the fact that such physics will appear the world-unified physics with the uniform substance and uniform mechanical ether.

The help of new formation physicists will be required for its development. The publication and discussion of this article in periodic scientific editions will facilitate the search of such specialists. Their retraining can be done by universities at the departments of the world-unified physics that should be opened for this purpose.

COLD SYNTHESIS AT ELECTRONIC BOMBARDMENT

B.V. Bolotov, N.A. Bolotova, M.B. Bolotov, I.M. Bolotov¹

Kyiv, Ukraine

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The problems of oxygen transformation into carbon and hydrogen are considered. The authors have found out, that the atoms transformation mainly with nucleons number reduction before aluminum and silicon formation is observed at pulsing currents passing of the density about 105-8 A/mm² in fluids (for example in melted lead). Such reactions are accompanied with energy release as well. The authors also explored various views of self-focusing: interference self-focusing, electron-beams focusing, optical self-focusing, self-focusing at a ring discharge. Brief information on a self-focusing give a basis of atomic energy deriving, necessary for oxygen splitting into hydrocarbons.

1. Description

For the first time the strong magnetic and electric fields and currents, affected upon ferromagnetic substances, was executed in 1955-1956 by one of the authors. (see for example, B.V. Bolotov's applications [1, 2]).

The magnetic materials of small sizes were subjected to saturation from exterior electromagnetic systems in the described inventions devices, powered through detector diodes by alternating currents, with the purpose to excite extreme states in them. In particular the device called as: the "Inductive equalizer" allowed to excite spin waves at severe saturation of the small core, which led to conversion of inductive currents into capacitance. In other words, figuratively speaking, the chokes inductances converted into capacitance condensers.

Exploring the mechanisms occurring in ferromagnetic substances, B.V. Bolotov dealt with an exotic phenomenon of the ferromagnetic substance behavior at the current strong impulses. Using this phenomenon in magnetic dynamics,

B.V. Bolotov made the invention application called as: the "Method of particles acceleration and information transmission" [3]. The discovered phenomenon termed by the author as the "Nonelectromagnetic agent", allowed not only to accelerate particles, but also to melt metals at room temperatures.

The pulsing currents of high density (up to 10⁶⁻⁸ and/mm²) explicitly yielded reorganizations in atoms. So the author made out the discovery application called as: the "Law of ferromagnetic radiation" [4], and the discovery application called as the "Chain reaction effect in the ferromagnetic substance" was made a bit later [5]. The authors described in these discoveries applications that the nuclear reorganizations of ferromagnetic substances are accompanied by radiations even of

X-rays. Many various experiments for the proof of substances nuclear transformation were carried out since that time. And these experimental confirmations were obtained. Many documents confirmed the superiority of our author's discovery, which was recognized also all over the world.

The authors made the special pulsing device for induction affect upon oxygen containing substances with the purpose of oxygen splitting into fragments, i.e. carbon and deuterium:



If electrons masses for oxygen can be taken:

$$M_{e(o)} = 0.0006114 \text{ a.e.m.},$$

electrons masses for carbon,

$$M_{e(c)} = 0.0005663 \text{ a.e.} \text{ and electrons masses for deuterium,}$$

$$M_{e(d)} = 0.0005174 \text{ a.e.m.}$$

So the energies will be for oxygen accordingly $W(O) = 4.55 \text{ MeV}$, for carbon - $W(C) = 3.029 \text{ MeV}$, for deuterium - $W(D) = 4.8 \text{ MeV}$.

The equal energy is formed at nuclear carbon linking with deuterium:

$$W = W(C) + W(D) - \\ -W(O) = 3.029 + 4.8 - 4.55 = 3.279 \text{ MeV}. \quad (2)$$

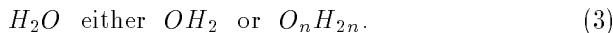
If on the contrary it is required to split oxygen into carbon and deuterium, so perhaps the energy of the same order is required for splitting.

The problems of oxygen transformation into carbon and hydrogen are considered i.e. into hydrocarbons in the paper shown below, though this technical problem is expensive and requires major means.

The oxygen split into hydrocarbons is the contemporary essential problem, as hydrocarbons are the way of protein obtaining, i.e. food products at first.

¹E-mail: larichuk@yandex.ru

Oxygen in the earth medium takes rather considerable place. They are the minerals - oxides of earth's crust at first. But water (H_2O) is the main raw material for oxygen processing into hydrocarbons. Really, formula of water is noted as:



Hydrocarbons are written down as C_nH_{2n} usually. It can be noted comparing hydrocarbons with water that the water O_nH_{2n} differs from the hydrocarbons formula C_nH_{2n} only by deuterium atoms content in water (see 1). Thus, it is enough to split deuterium from water oxygen for hydrocarbons deriving from water.

We shall give some information about oxygen taken from manuals.

The oxygen nuclear number is determined by protons number containing in it and it is equal 8, but the relative nuclear mass in the ratio with nuclear carbon mass ($C_{12} = 12.0000$) is equal 15.9994.

Oxygen was discovered in 1774. by J. Priestly (Leeds England) as well as K. Sheele (Uppsala, Sweden) independently [6]. The title for oxygen was given from the Greek word "oxy genes" - generating acids). Oxygen is gaseous, without an odor, is chemically active, easily forms oxides with all known elements except for He, Ne, Ar and Kr with which they conjugate hard.

Oxygen is dissolved at $+20^\circ C$ about $30.8 \text{ cm}^3/l$ in water. Electronegativity is 3.50 eV (according to Allred), a kern charge is 4.45 (according to Klementy).

The melting temperature is 54.8 K, boil temperature is 90.188 K. The density is

1120 kg/m^3 (fluid). The number of isotopes (including isomers) is 8. A gamut of radioactivity masses is $13 \rightarrow 20$. The basic isotopes are $O_{15.994915}^{16}$ (in nature 99.76%), $O_{16.999311}^{17}$ (0.048 %), $O_{17.999160}^{18}$ (0.20 %).

The oxygen is included into the DNA composition, about 16 % of it is contained in muscle tissue, about 28.5 % of it is in bone tissue. The oxygen like O_2 is not toxic, but it is toxic like O_3 . There is 43 kg of oxygen per 70 kg of a man weight. There is oxygen about 47.4 % in the earth's crust. There is oxygen about 20.95 % in atmosphere, i.e. about $1.2 \cdot 10^{15} \text{ t}$, thus the world manufacture of it is about 1.10^8 t/year .

Oxygen isosteres are formed of coal acids: H_2C , D_2C , T_2C and LiC . That is $H_2C \rightarrow O_{14}^8$, $D_2C \rightarrow O_{16}^8$, T_2C , O_{18}^8 and $LiC \rightarrow F_{19}^9$.

All these substances are transmuted into oxygen and fluorine at major pressing, thus maintaining its acid properties. A lot of energy is required to split oxygen into carbon, however this technology urgency is about to happen currently.

As the oxygen splitting is possible only at rather major energies it is necessary to use atoms transformation reactions for industrial hydrocarbons deriving, at which sufficient energy amount is released. The authors designed the device (Fig. 1) for this technology realization, permitting to obtain the energy sufficient for the

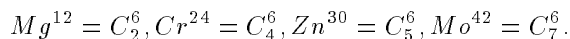
realization of oxygen splitting reaction into hydrocarbons.

In the test device: 1 is a power transformer of a spot welding having the power 10 kW feeding from the power of 380 V.

The winding 2 consists of 100 coils of copper chips with the section ($S_1 = 33 \text{ mm}^2$). The winding 3 consists of one coil cast of copper with the section ($S_2 = 904 \text{ mm}^2$). 4 is the choke consisting of one coil of a copper wire with the section 10^4 mm^2 , made together with the wire 3 by melting. The secondary winding 6 of the choke consists of 50 coils of copper chips with the section 100 mm^2 . The section of the core 4 is equal 100 cm^2 . The condenser 7 is used for the set-up of 4 choke on the web multiple frequencies (100, 150, 200: Hz) of alloys kerns current division. In order to obtain e.d.c. on electrodes 9 and 10 of the asymmetric shape. The condenser 8 is intended for MICROWAVE - oscillations bridging occurring in a chain of electrodes contact 9 and 10. 9 is a contact electrode, made of multisheet pliable aluminum or copper, connected to the copper tip 15, sharpened at the end. Despite of large electrode section (about 200 cm^2), it has good pliability. 10 is the contact electrode, made of, as well as the coils 3 and 5 of a continuous copper cast material of identical section, which is connected to the container 1, having copper core 12, on which a small high-melting molybdenum container 14 with the melt 16 is disposed, being a kernel-fissile substance for the experiment. The container 11 is filled with the melt of deuterated alkali KOD, coating the small container 14 with a top, as shown by a dotted line. 17 is a wire reel consisting of 7 coils of 3 mm diameter wire, plugged to the bulb 24 volts 100 W, intended for the recording of high-frequency induction magnetic field occurring in the contour of electrodes 9-10 at the expense of nuclear phenomena in the melt 16 from currents passing through it (including induction currents, occurring at the expense of nuclear processes) with the density reaching up to 10^6 - 10^8 A/mm and about 10-15 thousand of volts. 19 is the obscure chamber with a microhole and film anchored on the opposite side of the chamber. The chamber is intended for recording a strong gamma and X-rays. 20 is the dosimeter of neutrons and X-rays with the data unit CBM-20 with a feeding voltage for the data unit - 400 V.

Carbides, oxides and sulfides of a chromium, molybdenum, magnesium, zinc for carbon lines excitation are added to the melted composition, as the atoms of a chromium and all remaining numbered elements make carbon lines.

Really:



The microammeter such as M 4204 (GOST 8711-60 $\pm 50 \text{ mK}$) and the tester C4315 on a scale 1-volt of

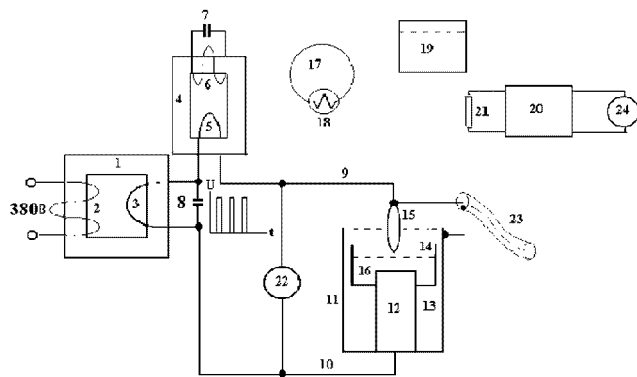


Figure 1: Principle scheme of the experimental laboratory model

the direct current was used as the indicator 24.22 is the oscillograph for the observation of superhigh-frequency voltage impulses, which exceeds tens thousand volts as for the amplitude. 23 is the wave-guide for takeoff and measuring of MICROWAVE - oscillations, which is connected to the electrodes 15 and 12 in parallel. Lead protection, ventilator and the gas collectors in the figure 1 are not given. Everything is covered with distilled water. There are a lot of deuterium, methane, ethane, butane and other hydrocarbons as well as a pair of heavy metals (quicksilver, bismuth, thallium etc.) at arc-like process among a great number of black color released gases.

2. Purpose of the experiment

Experimental confirmation of various substances origin and radiation of X-ray and high-frequency radio emissions of high-power radiation at a molecular nuclear level occurring during currents passing through substances melts of the density up to 10^6 – 10^8 A/mm².

A preparatory part of the experiment. The alloy 16 and deuterated alkali 13, consisting in the experiment of lead 30 %, tin 50 %, phosphoric copper 15 % (with phosphorus content in copper up to 5 %), deuterated alkali (KOD) up to 5 %, non-mixed in the alloy any more by separate heaters, which have not been shown in the figure, are melted.

The current passing checkout at a short circuit of the electrode 15 with the substance 16 is executed up to melting of atomic active substance. It did not result in the radiation detection by the means available in the experiment at a short circuit of the electrode 15 with the substance 16, though the currents densities had maximum - possible values. The contact currents decreased after the alloy 16 melting, however, there was a stationary value component of the current up to 30% of the variable component value. Thus the electrode 15 became the cathode in relation to direct current, i.e.

minus, and the melt became anode. The electrode 15 was warmed up so slightly due to the indicated property of a contact chain of the electrode 15 and melt 16 that did not require cooling in the experiment. While the melt 16 was warmed up to the temperature more than 1000°C. The availability of parallel pulsing currents through the melt 16 with the greater stationary value component result in accelerating phenomena forcing to scatter kerns to the sides perpendicular to currents axes, as it happens in parallel conductors with unilateral currents. The accelerating phenomena pull together kerns on the distance about the affect radius of nuclear forces (10^{-13} m) and at the expense of it there is the hydrogenous atoms transfer from kern to kern (mainly deuterium) by our hypothesis, with which the melt system is occupied up to a particular level. The measuring and control means allowed to register the following kinds of radiation.

A) Electromagnetic radiations in the range higher 2- 10 MHz by the indicator reel 17, which at its approach to the contour axis 9, 15, 16, 12, 10, 8 ensured a bulb heating with complete luminosity by induction currents. Thus more than 100 W of power was perceived. The occurring power of MICROWAVE oscillations is about 10-100 kW according to the calculations, and the expendable power of a primary circuit does not exceed 5 kW in steady conditions.

B) The dosimeter 20 registers low-speed neutrons and X-rays (weak gamut). The indicator (microammeter) is at the scale top and the tester shows about 1 volt. The results exceed background radiation approximately in two degrees.

C) The film of the sensitivity 64 ASA of the obscure chamber 19 at the device operation duration about 1 minute did not allow to register radiations.

D) Chemical analysis of the obtained slag after ten-minutes process above the substance 16 allowed to find out quicksilver, tallium, bismuth, silicon, aluminum, nickel missing in the initial raw material.

Deductions: the experimental laboratory device of the alloy atoms current division confirms nuclear transformations occurrence and gives the basis to the development of more perfect devices.

Thus the authors confirmed that nuclear transformations are carried out on the basis of the **Phenomenon**, which is stated as: **The atoms transformation mainly with nucleons number reduction before aluminum and silicon formation is observed at pulsing currents passing of the density about 10^{5-8} a/ mm² in fluids (for example in melted lead). Such reactions are accompanied with energy release as well.**

The authors found out two phenomena analyzing the current formation at pulsing currents affect through melts or solid substances, which are specific for these processes.

The authors called the first phenomenon as: the

"Phenomenon of a ball lightning" [7], which was announced at the USSR State Committee in the field of inventions and discoveries. The second phenomenon as: the "Phenomenon of a self-focusing" was also announced at the USSR State Committee in the field of inventions and discoveries [8]. Let's give brief information as to the numbered discoveries.

3. Fotmation regularity of a ball lightning

The ball lightning is a phenomenon, connected mainly with an atmospheric electricity and observed frequently during a thunderstorm. The detailed investigations show that the final resolution of the ball lightning nature does not exist until nowadays. However it is not disputed that the ball lightning has a spherical surface (sometimes partially oval) that its sizes do not exceed 30-35 cm, that its color is mainly red, or red - yellow (sometimes bright, as at welding), that its lifetime is some seconds (about one minute in some cases), that its disappear is accompanied silently or with a crash (similar to the condenser electrical discharge), that its plasma temperature is tens and hundred thousand degrees (much higher temperature modes are possible) also. In 1948 one of the authors B.V. Bolotov [7] stated that the ball lightning is a conservative system of the ether medium vortex formation like the Helmholtz' rings originated as the primary response result of the thunderstorm electrical discharge. The guess essence is in the fact that a magnetic field is formed during the electrical discharge along the spark gap (cloud - the Earth) as around the conductor with the current. The magnetic field, appeared in the ether space with anything that is not bound, aims to disappear after the discharge finishes. However, if the magnetic field disappears in the reel, so E.D.C. is laid in it. In that case, when the magnetic field is formed by one conductor (a lightning spark channel), so the magnetic field is distributed along the whole length of this channel. This field is capable to excite an electromotive force in volts of the same or even greater order at its disappear that was at the moment of the linear lightning discharge. In other words, E.D.C. of self-induction should charge again the cloud and Earth in hundred millions volts with opposite sign as the condenser.

Such case is actually possible also, when the arisen spark will become isolated on itself. The generated current will impede prompt disappear of the magnetic field at the arisen self-discharge, as it happens in choke coils with ferromagnetic cores, made of continuous (non-burden) electrical-conducting cores. We observe the process retardation of a magnetic field decrease at the expense of vortex currents in electrical-conducting ferromagnetic cores. There is also such a phenomenon in the E.D.C. discharge system of self-

inductions, when the discharge spark current presses a magnetic field, distributed along the discharge channel, increasing the discharge area practically for the whole surface enveloping the magnetic field clot. The distributed magnetic field along a pole is pressed in a torus of the shapeless spark discharge during micro seconds fractions, the magnetic field, in which it gains major value in some orders, than it was along the discharge column. The magnetic field of high concentration is capable to develop the current of major force on a torus surface, that aims to press the magnetic field with greater force from one side and attenuate its disappear velocity on another side. The equilibrium mode of the formed clot occurs as a result, at which there is the attenuation of magnetic and electric fields on an exponential curve. Thus, the ball lightning is formed in the following sequence:

1. The discharge of the condenser (cloud - ground). At this stage, the charges dispersed in cloudy formations, reflux into one basic discharge channel, which is made, as a rule, without a ramification. Here the discharge extensive network in clouds and non-extensive network down to the Earth basis.

2. The network size of the cloudy discharges decreases avalanchely at the discharge termination of the linear lightning as the cloud is a dielectric medium. In this connection the contact disrapture of the basic discharge column with a cloud allows to use the magnetic field energy, distributed along the basic channel of the linear lightning discharge. The disappearing magnetic field aims to recharge the condenser, i.e. a cloud - the Earth. But, as the connection with a cloud becomes practically impossible, the self-induction E.D.C. of the disappearing magnetic field is isolated in itself.

3. The formed spark pull off the discharge knot, due to what the magnetic field, distributed along the basic discharge channel, is pressed. The fact of the magnetic field pressing under the discharge current affect is observed not only in gas, but also in liquid mediums.

4. The magnetic field condensed into a clot is capable to develop the discharge current of major force, which aims to envelop practically the whole possible torus surface of the concentrated magnetic field.

5. The discharge current isolating on a torus surface, creates the magnetic field interfering the decrease of the basic pressed magnetic field. The process of the magnetic field energy consumption is accompanied according to the exponential law.

6. The torus surface current warms up plasma up to hundreds thousand and even one million degrees, at which the plasma conductance becomes higher than metals conductance (copper, argentum). The conductance losses are little in this mode. The energy of red-hot plasma, in basic, is expended for thermal and light emission. The plasma conductance increases with the temperature rise at the expense of electronic and ionic conductivity, which are opposite each other. The cur-



Figure 2: External view of the ball (tore) lightning

rents density reaches one million ampere per one square millimeter at the expense of the increased electroconductance. Such current density results in protons failure from air atoms or surrounding medium, which will begin to rupture up to fundamental particles (protons, neutrons, electrons).

7. The ball lightning is a nuclear reactor, in which there are protons movements and atoms transformations in plasma retained by a pressed magnetic field in a torus with electric currents on a surface.

Thus the ball lightning is the torus, or the Helmholtz ring formed by the electrical discharge and retained by cramped surface currents and magnetic fields (Fig. 2a). At the moment of the lightning formation, when there is a retraction of a magnetic field in a torus and the discharge surface increase, the lightning glow is maximum. Then, when the plasma conductance reached its maximum value and the lightning was pressed up to the optimum sizes, its brightness decreases sharply. The bright flashout is possible only at the lightning flashout, when the resistance increased by any reason in the current discharge chain. If to accumulate energy on the condenser (for example, in a Leyden Jar) and execute the energy point discharge, accumulated on the condenser, so the discharge currents with the density about one million ampere per a millimeter square will result in nuclear substance transformations. The energy e.d.c. of self-induction can be much greater in this mode, than the energy taken at the condenser discharge. The aftereffect impulses energy exceeded the brought impulse energy in tens thousand times in the prototype machines. This fact is considered as a discovery by the authors and it is noted under a title: **a phenomenon, which exhibits itself at pulsing affect by currents of high density, through intermixtures of special substances being in a solid, fluid, plasma state, there are aftereffect impulses, which electrical energy exceeds the brought impulses electrical energy considerably.**

Let's give some calculation parameters of a ball lightning, or a tore lightning, to be more exact, as it is a torus instead of ball in essence. It is difficult to notice at the moment of its formations and bright glow that the ball lightning has tore-like shape. Let's allow that the visual boundaries of a tore lightning are the real boundaries of vortex currents as well making it,

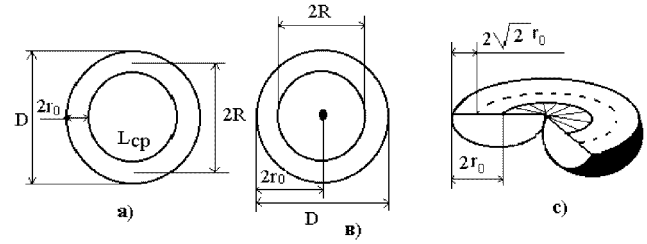


Figure 3: Geometrical parameters of the tore lightning

as input data simplifying the analysis. We shall accept it as the second assumption that the process of magnetic field attenuation occurs on an exponential curve at the expense of electrical energy transformation into the light thermal and visual beams. Let's assume also that the made vortex currents flow along the whole torus mass and that the plasma conductance in the whole torus volume is identical. Resulting from the given assumptions, it is possible to consider that the lifetime of a ball lightning will be approximately 3τ , as the transition exponential process for the indicated period finishes almost completely. This time is easy to define, if the torus inductance and ohmic resistance are known. It is possible to use the ready formula for a ring inductance to define the torus inductance (Fig. 3a)

$$L = 4\pi \cdot 10^{-9} R \left(\ln \frac{8R}{r_0} - 1.75 \right). \quad (4)$$

Here: L is the inductance in a henry; R , r_0 are the sizes in centimeters.

If to consider that the size r_0 is equal R , so the ring inductance will be equal:

$$L = 4\pi \cdot 10^{-9} R (\ln 8 - 1.75). \quad (5)$$

The inductance of a torus along the whole volume is equal to the ring inductance, as the whole torus mass is united by a uniform magnetic field.

The ohmic resistance for vortex currents can be defined according to the formula:

$$R = \rho \frac{l_{mid}}{S}, \quad (6)$$

where: l_{mid} is the medial length of a vortex current trajectory (Fig. 3b); S is the section of electrical-conducting mass (Fig. 3); ρ is the specific plasma resistance.

The plasma active resistance is obviously necessary for estimation taking into account the use of half section of active plasma mass. According to (Fig. 3c) the active area is determined as:

$$S = \frac{\pi D^2}{8} = 8\pi R^2. \quad (7)$$

where D is the lightning diameter equal to $8R$.

In this connection l will be determined as:

$$l_{mid} = \pi d_{mid} = \pi \left(\frac{2\sqrt{2}R}{2} + \frac{4R - 2\sqrt{2}R}{2} \right) = 2\pi R. \quad (8)$$

As a result the general ohmic resistance will be equal:

$$R_{om} = \rho \frac{l_{cp}}{S} = \frac{\rho}{4R}. \quad (9)$$

Finally, the general lifetime of a tore lightning will be:

$$T_{com} = 3\tau = 3 \frac{16\pi R^2 \cdot 10^{-9} (\ln 8 - 1.75)}{\rho}. \quad (10)$$

Having given numerical coefficients to one, we'll obtain:

$$T = 4.7 \frac{R^2}{\rho} \cdot 10^{-8} \text{ sec.} \quad (11)$$

It is possible to estimate approximately a tore lightning lifetime according to the formula if to give other unknown parameters. Really, the size R can change depending on the force of the linear lightning discharge in the range of several centimeters up to one meter. The specific plasma resistance changes in the range of copper conductance and even sometimes in the order less, i.e. c should be taken equal $c = 1.75 \cdot 10^{-7} \text{ Ohm} \cdot \text{cm}$. These parameters show that the tore lightning general lifetime can change from several seconds up to several tens minutes. Some obtained data are confirmed by the various investigators multiple times, and also they are confirmed by the eyewitnesses. Let's estimate roughly the tore lightning general energy. It consists, probably, of several energy kinds.

1. The plasma energy being under high temperature potential, reaching up to tens millions degrees, heated as a result of the magnetic field pressing by surface currents.

2. The kinetic energy of ions particles vortex gyration, non-participating in the current discharge and retained by the pressed magnetic field.

3. The magnetic field energy pressed by a current.

4. The atomic energy, originating as a result of light atoms fission and synthesis, arises of the protons, neutrons, electrons retardation.

If to neglect with the first two energy kinds, so for the estimation of tore lightning energy, it is enough to use the formula:

$$W = \frac{Li^2}{2}. \quad (12)$$

If the size R can be chosen equal 100 cm in the formula (11), and the discharge current value of the linear lightning can be chosen in the range $10^5 - 10^6 \text{ A}$, so the magnetic field energy will be approximately from 2 up

to 200 kilojoules. This whole energy is transmuted into radiation, thermal and light energy at quiet lightning disappearance.

The tore lightning forms large loops of the current discharge at explosion. If such discharge is yielded on a tree or other thing, saturated by moisture, so their distractions are possible on the basis of electrodynamics shock (Utkin's effect). The current discharge of the tore lightning can be also fatal as for a man as for an animal. The tore lightning can impose major material damage to property, equipment, machines, airplanes etc.

The tore lightning, however, can be used for servicing people as well. Here are some examples.

1. The tore lightning is a radiant of high-temperature plasma suitable for the thermonuclear boiler burning.

2. The tore lightning can be used for the thermal atomic process keeping inside itself, for what the atomic hydrogen should be shoot into a torus on tangential to a magnetic field bundle at a high speed due to the fact that there are huge efforts of magnetic fields pressing into a tore-like bundle.

3. The tore lightning is the accumulated energy source, it can be favorably used for physical experiments, as well as in transport for motion acceleration or airplanes take-off.

4. The tore lightning is the major magnetic fields source. Really, if the magnetic field along the discharge channel was about 10^5 oersteds at the moment of the linear lightning discharge, so this field will increase up to 10^8 and more oersteds after the magnetic field pressing by enveloping current and nuclear transformations.

5. The tore lightning is a nuclear boiler, in which it is possible to yield nuclear substances transformations and not necessarily as tore-like shape primly in gaseous, liquid and solid medium. It can be created in laboratory requirements from the high-voltage condenser batteries discharge. And the tore lightning does not only transform currents, but also can behave as the transformer of electrical energy into nuclear one and vice versa, nuclear into electrical. In other words, the tore lightning can produce much more electrical energy than the consumed one for its formation at the expense of substance nuclear transformations. The pulsing currents of 200 ampere at the voltage 25 volts are conversed to currents of one million ampere and tens thousand volts in the designed device.

The tore lightning by virtue of nuclear reactions occurring, radiates super-high radio frequencies (hundred megahertz). Therefore the currents flow basically on a periphery in the tore lightning, so the magnetic field will be fixed at the torus center. That's why there is a continuous interrelation through the self-focusing phenomenon between a magnetic field and current, which, probably, retains gaseous particles from dispersing. Let's consider this phenomenon, discovered by the authors, in more detail.

4. Interference self-focusing

The self-focusing phenomenon of electromagnetic and sound beams, being in the beams divergence reduction (or convergence magnification) due to the occurrences of a cross gradient of a nonlinear refraction index and a nonlinear wave guide occurrence, a bundle section decreasing (see the G.A. Askaryan's diploma for discovery) is known [9].

We found out other modification of the self-focusing phenomenon [10]. This is the beams divergence diminution (or convergence magnification) due to the close-loop interference waves occurrences concurrent with amplitude magnification to the center or pole. The described self-focusing phenomenon takes place in the linear system. However, nonlinear self-focusing processes occurrence is possible at high-energy concentration, which are similar outwardly to the origin processes of a nonlinear wave guide. We shall explain the phenomenon essence as the fluid surface vibration example with the help of the point and ring vibrator. There will be concentric waves from the contact touching place point if to perturb periodically the fluid surface by the point contact vibrator. Its amplitude will decrease in accordance with a wave removal from center. The apparent motion pattern of concentric waves can be observed in the opposite direction as well. It is necessary to perform fluid periodic perturbation by ring contact for concurrent waves reproduction. Waves will be divergent from the vibrator exterior side. The waves generated as a result of an interference, will be also circle inside a ring. But these waves will come nearer to the center, and their amplitude will increase under some optimum requirements as approaching to the center. In a general view of the interference wave inside the ring vibrator can be defined by the Bessel's functions. Thus a series of hindering circumstances present in mediums should be taken into account. Really, the interference self-focusing could be estimated on an example of the Bessel functions application to the known problem solution of the chain oscillations of small units. Analyzing this solution, it is possible to note, that the fluid behavior on single perturbations is similar to a chain behavior of small units:

$$\gamma(t) = \frac{1}{2} + \frac{1}{\pi} \int_0^{+\infty} \frac{\sin t}{\omega} d\omega. \quad (13)$$

If this phenomenon is correct, so the fluid surface will change its shape from a single impulse of each point source disposed on a ring, according to the law of a flexible thread. In other words, the wave inside a ring will not only be increased on amplitude, but also on frequency (Fig. 4). It occurs this way in the experiment. The interference wave shortens in its period inside the ring vibrator. On the contrary, if the fluid surface excites only in one point as single impulse, so the wave,

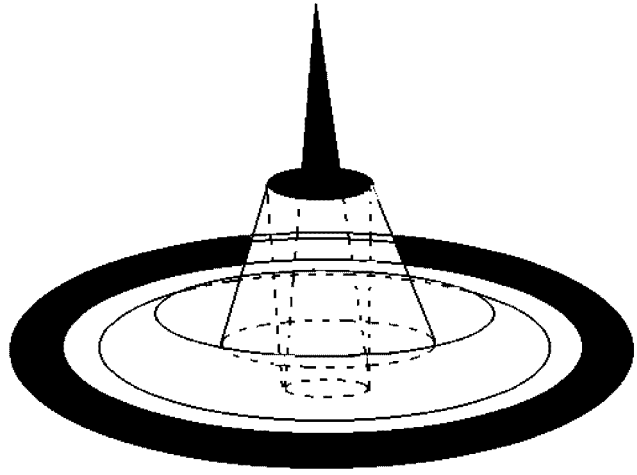


Figure 4: The amplitude and frequency of a self-focusing increases at the interference self-focusing

decreasing on amplitude, will decrease on frequency as well. The behavior analogy of a low frequency electrical filter on single perturbation is very close here. The response to single perturbation is represented as a sine curve decadent on amplitude and frequency at its output terminals. If the perturbation repeats periodically, so the self-focusing would be accompanied also by amplitude and frequency magnification at the ring vibrator. However the focussed wave reflects and interferes again with coming waves at small perturbation amplitudes. In that case, when the reflection requirements of focalized waves are good, the interference waves inside the ring vibrator cease to be running. The standing waves are formed inside the ring vibrator in this mode. The familiar pattern with round membrane oscillations is gained. Thus, it is necessary to foresee that the reflex wave would be minimal at the interference self-focusing phenomenon demonstration. Thus, there are divergent waves from a point contact, and the waves concurrent to the ring center with increasing amplitude are formed inside of it from ring contact.

The concentric wave ceases to exist at the center, being transmuted into pulsing outburst, at which the fluid usually sprays. The ordinary observations give also qualitative estimations. However, the amplitude magnification of an interference wave is possible only under those requirements, at which the energy density of the wave coming nearer to the center will increase. If the fluid is exited by a thing falling on its surface, so there is a packet of divergent concentric waves from a single impulse. If, on the contrary, the concentric wave will be closed into a point, so a single impulse will be as a result of it. Further we shall call this impulse as a quantum of interference self-focusing (QIS). Thus, here the wave corresponds to QIS, and QIS corresponds to the wave. And, we shall spread the described fact for

the spherical interference case. In other words, the pulsing medium excitation from a point source generates a spherical wave, and the spherical cramped interference wave can generate the concentrated energy impulse capable to be conversed to the divergent wave again, or partially to be conversed to other shape of the energy development.

Let's estimate the interference self-focusing phenomenon on an example of the mentioned experiment with vibration on fluid surface of a ring radiant.

The analysis should be conducted from the guess at a ring source application that the ring source consists of the point sources set located on the ring. The point sources waves interfere, forming a ring wave inside the ring also, but cramped as approaching the center. Taking into account that the point source wave in accordance with removal from the excitation place decreases on amplitude under the dispelling laws and losses registration in medium, so the interference wave can go out earlier at major ring diameters than it will be compressed into a point. In this case the interference wave amplitude magnification will not happen, though, basically interference self-focusing takes place. If a ring source radius can be reduced in its sizes, it is possible to find out the transition of some critical size of the ring radius, at which the interference wave amplitude will increase as approaching the center. We shall term this mode as auto amplification one further, as the source signal amplitude increases at the same signal energy expense. The interference wave amplitude amplification happens here at the volume reduction expense of the active medium mass, at which the energy density will increase. Taking into account, that the interference happens according to the energy conservation laws, so the focussed wave energy, naturally, will be less than the energy generated by a source. The source amplitude is small, but the source energy is distributed on the whole extent of a ring or sphere (for a spherical source). The active mass volume is extremely small in the maximum focusing point, but thus the wave amplitude will be great.

The self-focusing wave interrelation with the actuator wave can be expressed in a general view through the active mass volume. This interrelation can be expressed through the area for the wave case on fluid surfaces or any other elastic medium:

$$A_0 \Phi_0 = A_1 \Phi_1, \quad (14)$$

where A_0 , A_1 are the amplitudes of the actuator and interference self-focusing wave accordingly; Φ_0 , Φ_1 are the actuator areas, on which the interference of A_1 wave value was fixed.

The coefficient of amplification or auto amplification can be expressed both so amplitudes relation as active

areas relation, i.e.

$$K_0 = \frac{A_1}{A_0} = \frac{\Phi_0}{\Phi_1} = \frac{R_0^2 - R_0^{*2}}{R_1^2}, \quad (15)$$

where R_0 , R_0^* are the actuator exterior and interior radiuses; R_1 is the radius, on which the interference wave measuring is performed.

The wave amplitude value in center of a circle radius from ordinary source can be noted as:

$$A = A_0 B \sin \omega \left(t - \frac{R_0^*}{V} \right), \quad (16)$$

where R_0^* is the actuator interior radius of a ring source; V is the phase velocity of a wave distribution; ω is the circular frequency of the actuator oscillations; B is the decay coefficient.

The resulting wave amplitude at a ring source center can be defined as the total amplitudes of all ordinary sources located on a ring. If their number is equal n , the interference wave resulting amplitude A_{sum} at the actuator center will be equal:

$$A_{sum} = n \cdot A = A_0 B n \sin \omega \left(t - \frac{R_0^*}{V} \right). \quad (17)$$

Analyzing the equality (17) from the amplification deriving point of view, it is possible to note, that, if the product Bn will be more than a unity, so the interference wave amplitude amplification is possible in such a system. It is impossible to obtain the auto amplification mode in all other cases.

Consuming that the value n is proportional to the source circle length, i.e.

$$n = n_0 \pi 2 R_0 \quad (18)$$

and the value B is inversely proportional the circle areas, which is equal:

$$B = \frac{B_0}{\pi R_0^2} \quad (19)$$

so the requirement of the interference wave auto amplification can be realized only at

$$nB > 1 \quad \text{or} \quad R_0 < 2n_0 B_0, \quad (20)$$

where n_0 , B_0 are the medium parameters and determined by the experimental way.

The similar equations and auto amplification requirements can be obtained for the spherical interference self-focusing case.

The presented explanations of the authors' discovery essence give the basis to consider that the described self-focusing phenomenon concerns to the linear interaction phenomenon. Though the nonlinear phenomena occur as well. The nonlinearity is especially exhibited, when the interference wave at a circle center gains

maximum value. In this connection the self-focusing described in G.A. Askaryan's discovery (the diploma No 67) [9], perhaps, is explained inaccurately. And it is quite clear. You see, it is impossible to make a wave go (light beam, or sound beam) into a cone, as water into a whirlpool. The impossibility of such concentration, for example, light, was proved earlier. Therefore the self-focusing according to the principle presented by G.A. Askaryan, can not occur actually. The self-focusing or auto amplification of electromagnetic, ultrasonic, X-ray and other beams are possible only on the interference basis stipulated by the authors of the mentioned application for discovery. Thus the system generating interference self-focusing waves can be carried out not only as a sphere, ring, semiring or cylinder, but also like a rod, if self-focusing interference waves arise on vibration frequency in it at an end face. So the rod represents a set of rings inserted one into another. Therefore the self-focusing interference picture will not vary, as the interior rings are self-maintained ring sources creating self-focusing waves coinciding with self-focusing waves of other rings on a phase. Such multiring system has more strong effect of auto amplification that will allow to obtain major energy concentration in a focus point accordingly.

5. The scientific value of the authors' discovery and its possible application in science and technique

The interference self-focusing is a property of all mediums existing in Nature. Vacuum and biological entities as well as gases, fluids, plasma and nucleon fluid (temperature, at which all atoms are deprived of cohesive forces and all nucleons have free mobility, as atoms in melted metal) have this property. Interference self-focusing is spread for any beams. The sound beams of all bands, electromagnetic waves of all bands, thermal, optical, X-rays and gamma - quanta refer to them in particular. The interference self-focusing phenomenon allows to realize transformation of all energy kinds to all its forms. Let's consider it briefly in some examples.

5.1. Sound and ultra - sound lasers creation

Ultrasonic vibrators, which rods are made either like rings or solid bars, but thus it is necessary to select the relevant resonant frequency, at which the interference self-focusing wave will arise at end faces, are capable to create channels in fluids regarding elastic non-divergent beams. The specific feature of these beams is that they are isolated from the general medium by dielectric penetration difference. The authors offered to hang up superhigh frequency electromagnetic oscillations on the pole having excellent dielectric properties in comparison with surrounding medium, taking

into account the property of the focussed mechanical oscillations. This proposition originates directly due to parametric interrelation of ultrasonic phonons and spin waves electromagnetic quanta of the ferromagnetic rod and medium, which is in the maximum excitation state. For the first time the ultrasonic laser of similar type, by which the self-focusing phenomenon was performed, expressed in the detect of almost parallel pole of ultrasonic oscillations, separated from the basic medium by dielectric penetration distinction, was offered to use for electromagnetic waves transmission (Bolotov B.V., M.B. Kaplunov [10]. The transmission line with a surface wave from April 2, 1962). G.A. Askaryan's discovery priority was registered on June 8, 1966. The interference self-focusing on sound oscillations in fluids is not only useful from the point of view of the information transmission. It is useful to make the devices for rock processing. Really, the sound beam practically of any power can be created by an explosive method due to major fluid elasticity (for example, water). Very thick layers in mountain rocks, locating in water, can be punched by this beam. Let's note, that electrohydraulic shocks (according to Utkin's method), not subjected to a self-focusing by usual and known methods, are self-focusing according to the method, mentioned above, if to perform the electrical discharge not in a point, but on a ring.

5.2. Electrical signals amplification in auto amplification mode

In this mode the signal amplitude on the device output can be more than the signal amplitude on the device inlet. The output signal energy is less than the input signal energy. The amplification essence is in the cross-sectional area change of the interference device. Thus the amplifier system can be carried out with the operating speed, defined by swapping frequency and is about a half-period. In other words, the amplifiers based on the interference self-focusing method, allow to strengthen the signals of any nature on the same frequency, as the swapping frequency. The example of such amplifier is the device (Bolotov B.V. One-rod magnetic amplifiers with major amplification coefficients [1], B.V. Bolotov The inductive equalizer [2]).

The second device implements the idea of the inductive component neutralization by spin waves. It is reached due to the rapidly operating amplifier on ferromagnetic devices using the interference self-focusing.

5.3. The spin waves

The spin waves at the ring cores remagnetization can interfere in the ring core interior part under certain conditions, which, as a matter of fact, represents a tore lightning. And the interference wave maximum of spin perturbation will be at the ring center. The

same picture is observed in the tore lightning as well. The elementary checkout confirms that the impulse at a torus center is discovered at pulsing remagnetization of a ferrite ring, which renders physical affect not only on charged particles, but also on neutral atoms, separating fragments from them (protons, alpha particles etc.). And there are components of non-electromagnetic field at the focussed interference wave center. This field is stipulated by strong nonlinear interactions of the focussed electromagnetic field, due to what there is a broad radiation spectrum. As it was already mentioned, the authors termed this radiation as the "Non-electromagnetic agent".

The interference self-focusing helps to decide the fluids swapping problem, to explain the operation of insects wings, the heart operation. It considerably solves the problem of super-power lasers as well as nuclear transformations at relatively small energies.

The device (Fig. 5) was made for nuclear reactions realization. It consisted of the ferrite core 1, windings 2 and 3, connected oppositely - in parallel, the secondary winding 4, consisting of two coils of the copper bar with the section of 100 mm^2 , with tips 5 and 6, ceramic container 7, tested substance 8. The pole-tip 5 was made as a multilayer flexible copper strip, at the end of which the saw-edged ring was anchored. The flexible contact electrode was drowned into the melted substance by the lever (for example, lead). The pulsing voltage of the asymmetric form about 5000 volts was brought to the windings 2 and 3, located uniformly along the whole perimeter of the core 1. The transformation coefficient of the transformer 1 was given equal 10, so, that the voltage developed up to 500 volts on the electrode 5. The impulses duration was formed by the condensers of the total capacity 1500 mF, charged up to 6500 volts, and the discharge device was made with argon filling at atmospheric pressure. The impulses frequency was 0.5 impulses per a second, and the duration was about 40 nanoseconds. The winding 3, compensating the winding 2 inductance, had the section 10 % of the winding 2 section.

The working current in an impulse reached up to 1200000 ampere at a short circuit of electrodes. The pulsing current reached up to 800000 ampere in the melt of lead. In the scheme (Fig. 5a) the capacitance-inductive former for impulses forward front magnification was applied after a discharger, which is not shown in the figure.

Hundreds of nuclear reactions were carried out, which confirmed atoms transformation into fragments on the considered device. Many of these reactions are located in the application for discovery or already published. It was possible to prove nuclear transformations of compositions "metal - conductor" by this device. So, for example, the copper composition with silicon (copper doped by silicon) formed nickel, zinc, germanium, palladium and other atoms in the medium with lead.

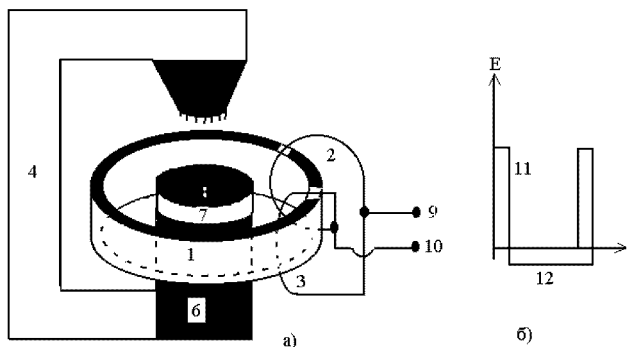


Figure 5: Principal scheme for nuclear reactions execution, using self-focusing

The composition of palladium with germanium, forms platinum and so on. The authors consider that the discovered nuclear transformations are especially interesting on metal-semiconductor boundaries, concerning the discovery and they exhibit themselves at the alloying of a semiconductor material with metals and at the presence of salt or metal melt (for example, lead).

ELECTRON-BEAM FOCUSING

In this connection the authors explored high-power electronic beams concentrated into a beam for electronic welding [11, 12, 13]. The similar device was announced in the application for discovery [21] and figured in the Fig. 6. It is made according to the conventional scheme and with usual focusing, but with introduced elements of self-focusing realization by the authors' method, i.e. the electronic beam is focalized as a small ring beforehand. The electrons, falling to the metal surface, excite interior reaction as waves in it, which will yield the cramping effect according to the self-focusing phenomenon. Thus, the electronic ring is squeezed into a point inside metal. It will yield considerable temperature increase and essential changes in a substance including to nuclear transformations. The authors noted that the electronic focussed beam mainly results in the separation of protons, neutrons and deuterium atoms.

The authors are surprised to consider the Stanislav Adamenko plagiarism, which borrowed the authors' discovery and asserts that it is his one, widely publishing it in the newspapers [22].

Here are:

- 1 — Power source of the direct current electron - beam gun;
- 2 — electron - beam gun;
- 3 — vacuum camera;
- 4 — electron beam;
- 5 — reel (some coils);
- 6 — electrode (cylindrical);
- 7 — source of a direct current for making a plasma arc;
- 8 — processed product.

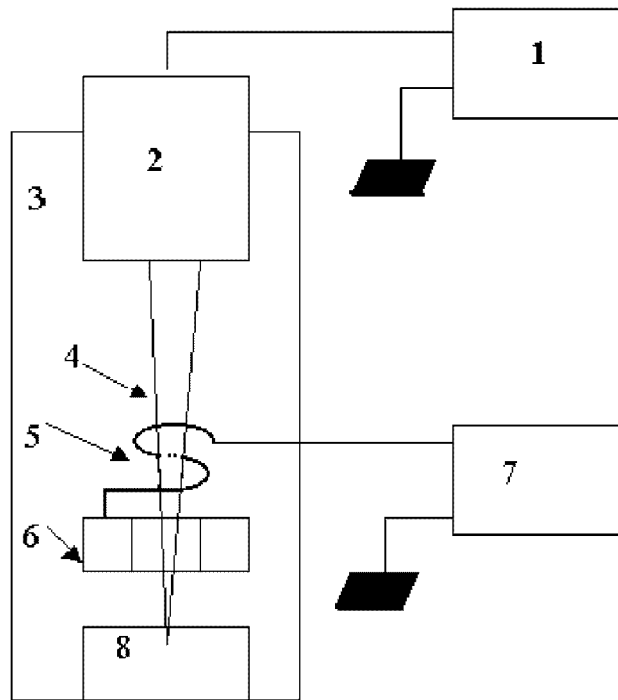
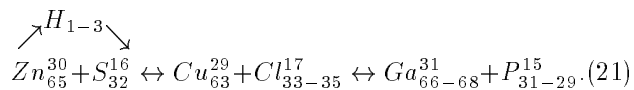


Figure 6: The device for electron-beam welding

The electron beam was passed through plasma created by the source 7-volt arc in the proposed device. The authors noticed that the product warm-up by a plasma arc increased considerably the beam welding efficiency. The combined effect of an electron beam and vacuum plasma resulted in the X-rays level magnification. The voltage on accelerating electrodes did not change, therefore the occurrence of X-rays increased level was inexplicable. We began to work on different materials and established that there is the increased radiation level in the device on welded samples. Especially the ionizing radiation background increased if substances mixtures or compositions such as: sulfide of zinc, sulfide of cadmium, sulfide of lead etc. were treated by the electron beam with plasma.

TRANSFORMATION OF ZINC SULPHIDE

The authors discovered the lines of copper, gallium, germanium, phosphorus and silicon at the treatment by an electron beam of chemically pure zinc sulfide. The reactions went according to the scheme:



The element transformation products detection at the expense of an electronic bombardment in vacuum plasma in the electron-beam apparatus, the authors consider that the **Phenomenon**, which exhibits itself by an **electronic beam focussed bombardment in vacuum plasma**, has been implemented.

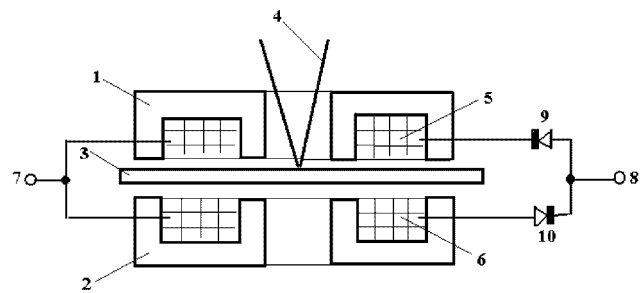
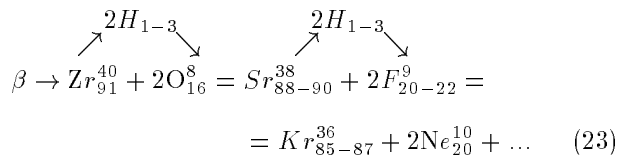
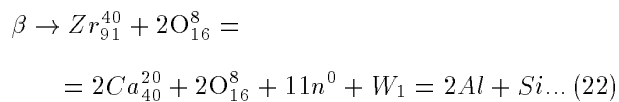
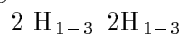


Figure 7: Magnetic focalizing lens providing electron beam self-focusing

ZIRCONIUM OXIDE IN ELECTRON BEAM STREAM

The authors have paid attention to the changes happening in substances structure at electron-beam welding [11, 12] studying the described **phenomenon** bombardment by focussed electronic beam in vacuum plasma on various magnetic systems. The special electromagnetic device for an electron beam focusing (Fig. 7) was made with this purpose. Then the necessary experiments were carried out by an electron beam substances treatment. The tested piece is between two electromagnets and the electrons of an electron beam gather a high speed at the expense of it, and the tested substance atoms, having major temperatures, are subjected to nuclear changes in the designed focalizing device. So, for example, zirconium transformations into calcium, aluminum, silicon, molybdenum as well as occurrence of other extra elements were revealed at the treatment by an electron beam of zirconium dioxide. The nuclear reactions of zirconium splitting go according to the scheme:



Many other atoms are not specified also in the reactions (22) and (23). One thing is clear that the magnetic field of focalizing system starts nuclear transformations of substances.

The magnetic system of the focalizing device is made of two electromagnets 1 and 2, manufactured like a pot model. There is the basin 3 of tested samples between electromagnets poles. The magnetizing reels 5 and 6 ensure a suitable magnetic field. The alternating voltage with the diodes 9 and 10 is made to these reels according to the scheme that the constant

magnetic field comes outside the magnetic poles boundaries. The focussed electron beam 4 affects upon the substance together with a magnetic field, which is in focussed electron beam range. Thus, the authors, engaged into similar investigation, defined a considerable phenomenon. This phenomenon, resulting in nuclear transformations, is discovered at **Electron beam focusing by the magnetic field, occurring at focalizing system magnetization by the variable semi-periodic magnetic field.**

OPTICAL SELF-FOCUSING

The authors have noticed, analyzing the processes of a focalizing electron beam that the magnetic focusing results in self-focusing phenomenon. And it, obviously, plays a considerable role in nuclear transformations. Really, such processes are perfectly real, therefore we shall investigate them on optical range waves [16, 17].

Physically the self-focusing phenomenon, as it was already explained, consists of the following details. We shall note again to pay attention to this phenomenon, that concentric waves will appear on fluid surface, if the spherical thing falls onto the fluid surface. The concentric waves, which will gradually go away, will appear around on the liquid surface from the thing falling. Waves amplitude will decrease in case of waves removal from the thing falling center, but their following period will increase. If the fluid surface can be shaken by a ring hoop, so the waves will run to the center inside a hoop. These waves amplitude will increase, and their following period will decrease. In other words, the energy in focus does not only strongly increase at a self-focusing, but the frequency increases as well. There is the similar energy magnification and frequency magnification at the electron beam focusing as well. It, ultimately, also results in nuclear transformations in the irradiated substance. It is possible to find out similar, but special kind of energy transformation in the ether medium [16, 17] if to realize the self-focusing on optical beams. The special reflecting device was made for this purpose (Fig. 8).

The reflecting device consists of two conical mirrors 1 and 2. The conical mirror 1 has a reflecting surface outside, and the mirror 2 has a reflecting surfaces interior. The conical mirror 2 has the small hole 6. The entering light front comes into the ring slot 3 - 4 and the light beams 5 leave through the hole 6 at the expense of a multiple reflection from the reflecting surfaces of the cones 1 and 2. The concentrated light beams become not only considerably focussed, but also are converted to the frequency increase side. The ring light front can be obtained from the infrared laser, and the output beam will have components already in the visual spectrum area. The authors termed this experimental fact as the **Phenomenon**, which exhibits itself at a **self-focusing of the ring concentrated optical beams**.

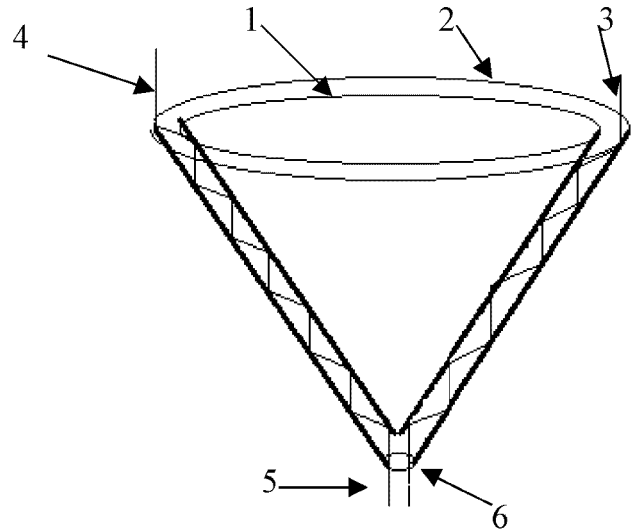
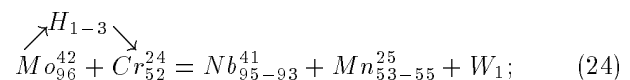
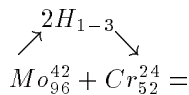


Figure 8: The reflecting device for transformation of light beams ring front

SELF-FOCUSING AT A RING DISCHARGE

The self-focusing is possible on the electrocurrent discharge as well. The authors noticed such self-focusing at Utkin's effect study, i.e. at the discharge of high-voltage capacitors in fluids (for example, in water). The authors modernized Utkin's experiments and began to realize the discharges of condensers in water not in a point, but in a ring. The Utkin's effect increased in tens times, it became possible to handle materials at reduced voltages [19]. Nuclear substance transformations were observed at increased voltages (up to 20-30 kilovolts) on anode and cathode electrodes. The authors used the molybdenum plate of 12-mm thickness as the anode electrode. The tube from pure chrome of 30 mm diameter, 1,5 mm thickness as the cathode electrode. The tube end had the pointed thorns as needles. There were 49 needle thorns, the thickness was about 0,5 mm at the bottom. The cathode electrode was placed above anode one apart 6-10 mm. All electrodes were immersed into bidistilled water. The capacity of condensers was 1600 F. The operational voltage was 5000 volts. Then the discharges through argon gas discharger were made. A part of turbid water was taken after the first discharge, the sediment was dried and analyzed by the spectrum analyzer F-8. The effects of the obtained powder were compared to the effects of initial chromium and molybdenum. The atoms occurrence missing in initial samples was defined as a result of such comparison. Namely: nickel, silicon, zirconium, aluminum, calcium, niobium, iron and some others were found out. The reactions of nuclear transformations can obviously be noted as:





$$= Zr_{94-90}^{40} + Fe_{54-58}^{26} + W_2 \rightarrow 2Ca^{20} + 2Al^{13}; \quad (25)$$

$$Mo_{96}^{42} \rightarrow 3Si_{28}^{14} \rightarrow Ni_{58}^{28} + Si_{28}^{14} + 10n^0 + W_3. \quad (26)$$

Thus, the authors revealed the substance transformation phenomenon on the basis of the electrical discharge self-focusing, which was termed as the **Phenomenon**. It is implemented **At the expense of nuclear transformation of molybdenum and chromium by high-voltage electrical discharge, occurring between the ring cathode electrode with the needle ends and the flat anode.**

It is curious to note that the point current discharge results in the self-focusing of elementary electronic currents.

Thus, brief information on a self-focusing give a basis of atomic energy deriving, necessary for oxygen splitting into hydrocarbons. We shall inform in the subsequent articles what are these substances and other peculiarities.

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ENHANCEMENT MECHANISMS OF LOW ENERGY NUCLEAR REACTIONS

F.A. Gareev¹, I.E. Zhidkova² and Yu.L. Ratis

Joint Institute for Nuclear Research, 141980, Dubna, Russia

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The aim of this paper is to discuss the possibility of inducing and controlling nuclear reactions at low temperatures and pressures by using different low energy external fields and various physical and chemical processes.

1. Introduction

One of the fundamental presentations of nuclear physics since the very early days of its study has been the common assumption that the radioactive process (the half-life or decay constant) is independent of external conditions. Rutherford, Chadwick and Ellis [1] came to the conclusion that:

- “the value of λ (the decay constant) for any substance is a characteristic constant independent of all physical and chemical conditions”.

This very important conclusion (still playing a negative role in cold fusion phenomenon) is based on the common expectation (P. Curie suggested that the decay constant is the etalon of time) and observation that the radioactivity is a nuclear phenomenon since all our actions affect only states of the atom but do not change the nucleus states. We cannot hope to mention even a small part of the work done to establish the constancy of nuclear decay rates. For example, Emery G.T. stated [2]:

- “Early workers tried to change the decay constants of various members of the natural radioactive series by varying the temperature between $24^\circ K$ and $1280^\circ K$, by applying pressure of up to 2000 atm , by taking sources down into mines and up to the Jungfrau-joch, by applying magnetic fields of up to $83,000\text{ Gauss}$, by whirling sources in centrifuges, and by many other ingenious techniques. Occasional positive results were usually understood, in time, as result of changes in the counting geometry, or of the loss of volatile members of the natural decay chains. This work was reviewed by Meyer and Schweider [3], Kohlrausch [4], and Bothe [5]. Especially interesting for its precision is the experiment of Curie and Kamerlingh Onnes [6], who reported that lowering the temperature of radium preparation to the boiling point of liquid hydrogen

changed its activity, and thus its decay constant, by less than about 0.05% . Especially of Rutherford and Petavel [7], who put a sample of radium emanation inside a steel-encased cordite bomb. Even though temperatures of $2500^\circ C$ and pressures of 1000 atm were estimated to have occurred during the explosion, no discontinuity in the activity of the sample was observed”.

It seems (in that time) that this conclusion was supported by the following very simple and strong arguments (Common Sense):

1. Nuclear processes have characteristic energies $\approx 1\text{ MeV}$, whereas chemistry has a few eV per atom, molecules have part of eV. The inner atomic shells are bound with many keV in the medium and heavy elements.

2. The localization of electrons in atoms is $\approx 10^{-8}\text{ cm}$, whereas the localization of nucleons in nuclei is $\approx 10^{-13}\text{ cm}$.

Therefore, the nucleus should be unaffected by superficial atomic changes: nuclear processes should not be influenced by the surroundings. The constancy of nuclear decay rates was firmly established, confirming evidences from experimental studies of α - and β - decays and theoretical estimations.

The constancy of nuclear decay rates acquired the strength as a classical law. Any papers contradicting this law were ignored by all the scientific journals as erroneous ones.

The history of science has own laws. The ground of the β -decay of nuclei was given by E. Fermi in 1934 year. It was very easy to prove that certain processes of radioactive decay should be intimately connected with the presence of atomic electrons and may be affected by the changes in the electronic structure produced by chemical compounds. It took 13 years to understand this very simple phenomenon. The possibility of altering the decay rate of Be^7 was suggested in 1947 by Segre [8] and by Dodel [9, 10]. In the case of electron-capture decays the decay rate is directly related to the density of atomic electrons in the nucleus and the ef-

¹E-mail: gareev@thsun1.jinr.ru

²E-mail: zhidkova@jinr.ru

fects of different chemical environments should be measurable. The theoretical foundation was the following [8]:

- “The radioactive decay constant of a substance decaying by orbital electron capture is proportional to $|\psi(0)|^2$ of the electrons. In the case of a light element like ${}^7\text{Be}$ it may be possible to alter this quantity by an appreciable amount by putting the Be in different chemical compounds. We would then have a slight change of the radioactive half-life of the Be in different compounds. The magnitude of the effect may be in the neighborhood of one percent, but it is practically impossible to give quantitative estimate because the total change of $\psi(0)$ is affected by certain factors such as the density of the crystal, nature of the chemical bond, etc. they are both positive and negative, and have comparable magnitudes. To obtain a reliable estimate of the effect we require a more detailed knowledge of the wave functions for various compounds than is at present available. Experiments are in progress to detect the effect by comparing the half-life of ${}^7\text{Be}$ in Be metal with that in BeO or BeF_2 ”.

The confirmed altering decay rate for ${}^7\text{Be}$ in different chemical compounds was of the order 0.1% [2]. The 6-hr isomer ${}^{99m}\text{Tc}$ decays by internal conversion of a 2.2-keV E3 transition. The observed effects in different chemical forms were of the order 0.3% [2]. The greatest chemically induced half-life changes of the order 3.5% were established in [11].

The half-life of ${}^7\text{Be}$ electron capture was measured [12] in endohedral fullerene ${}^7\text{Be}@C(60)$ and ${}^7\text{Be}$ metal: $T_{1/2} = 52.68 \pm 0.05$ and $T_{1/2} = 53.12 \pm 0.05$ days, respectively. This 0.83% difference between the electron capture in C_{60} and in ${}^7\text{Be}$ metal represents a strong environmental effect on the ${}^7\text{Be}$ EC capture rate, caused by the different electronic wave functions near the ${}^7\text{Be}$ nucleus inside a C_{60} cage and inside Be metal.

A weak interaction which is responsible for electron capture and other forms of beta decay is of very short range. So the rate of electron capture and emission (internal conversion) is proportional to the density of electrons at the nucleus. It means that we can manage the electron-capture (emission) rate by the change of the total density in the nucleus. It can be carried out in different macroscopic ways by using available environmental effects. These questions were highlighted in different reviews and books [2, 13-19] at the end of the seventies of the 20th century. The reader should compare the commonly accepted conclusions about the decay rates in the thirties and seventies of the 20th century.

Data on pleochroic halos led to the conclusion [20] that these data do not provide a convincing proof that the laws of radioactive decay are constant in time. Shnol S. and coauthors [21] came to the conclusion that the decay rates of radioactive nuclei change in

time with the period of 24 hours, 27, and 365 days. Periodic variations in β -decay rates of ${}^{60}\text{Co}$, ${}^{90}\text{Sr}$ and ${}^{137}\text{Cs}$ were discovered [22-25]. The 27-day and 24-hour period in these changes were found.

The aim of this talk is to discuss the possibility of inducing and controlling nuclear reactions at low temperatures and pressures by using different low energy external fields and various physical and chemical processes. The main question is the following: is it possible to enhance LENR rates by using the low and extremely low energy external fields?

2. Cold fusion and transmutation

In 1989 Fleischmann M. and Pons S. reported about their observation of nuclear products and excess heat on a palladium electrode during the electrolysis of solutions in heavy water. The electrochemical experiments were interpreted by the authors as a result of nuclear fusion reaction (named cold fusion) but the scientific community rejected this interpretation. More than 3000 papers in the field of cold fusion and transmutation (further the low-energy nuclear reaction LENR) were published. Various anomalous results were observed at low temperatures and pressures which are beyond the framework of modern theoretical paradigm. The theoretical models are not able describe these anomalies even qualitatively. The reader can find the history and problems of cold fusion in the Proceedings of the International Conferences on Condensed Matter Nuclear Science, the Russian Conferences on Cold Nuclear Transmutation of Chemical Elements and Ball Lighting, and also in a recent review of the Department of Energy of the USA

[26] and books [27, 28]. Russian experimental data on the low energy nuclear reactions are published in [29-32] and their new theoretical interpretation was given in [33-36].

The general important conclusion can be drawn from the studies performed during 15 years:

- The poor reproducibility of experimental results and extreme difficulties of their interpretation in the framework of modern standard theoretical physics are the main reasons of the persistent nonrecognition of cold fusion and transmutation phenomenon.

Recent progress in both directions is remarkable (see Abstracts ICCF-11, Marseille: France: 2004, 31 October - 5 November); in spite of being rejected by physical society, this phenomenon is a key point for further success of the corresponding fundamental research.

2.1. Reproducibility of Low-Energy Nuclear Reaction Experiments

Reproducibility of experiments within and between laboratories is a fundamental requirement and corner-

stone for any scientific investigations. There are many fundamental factors that are relevant to the issue of reproducibility (for details see [37]).

Everybody with a perfect ear will say that, for example, the viola play will have never be reproducible: it depends on too many factors (resonance conditions) which are impossible to repeat. The semiconductor effect in a transistor is extremely sensitive to damages and impurities of crystal which were impossible to control in the initial experiments. The degree of reproducibility was increasing over the years when the properties of used materials were improved and standardized, and the process was optimized and controlled with high accuracy. The same would happen for reproducibility of LENR [27]. We will show that this expectation for LENR is correct only partly.¹

The targets in standard nuclear physics using accelerators are the substances in the ground states: the gases, amorphous solids or crystalline solids. The projectile particle interaction with target nuclei has taken place in vacuum. Therefore, the influence of the surrounding matter (say, atomic electrons) on the velocity of such nuclear processes (especially at high energies) should be negligible. It seems that these expectations supported by estimations of energy and size differences ($10^{-5} - 10^{-6}$) of atoms and nuclei and experiments show almost a full reproducibility.

We come to the following conclusion:

- A greater part of processes in nuclear physics takes place in closed systems. Reproducibility of such experiments should be independent of the place and time of measurements - a cornerstone of the modern scientific method.

LENRs occur in the surroundings (gases, condensed mater, water, solutions, ...) which are induced by low-energy external fields as ultrasounds, electromagnetic fields, lasers, So atoms, molecules in the surroundings and atoms of interacting nuclei are in excited states or ionized. Nuclei, atoms, the surrounding medium, and external fields representing interacting subsystems form a dynamical open system. Frequencies and phases of subsystem motions may be coordinated according to the universal resonance synchronization principle (see Appendix) and the result may be a creation of a collective (coherence) state for the whole system. We will call such a system an auto-oscillation system in which the frequencies of an external field and frequencies of the whole subsystem are commensurable. The demand for frequency commensurability means that all motions in a system are in co-ordination (in resonance), which is difficult to fulfil. This is the cause of poor reproducibility of LENR.

¹References to original and review cold fusion literature are not given in our talk. They are available in the Proceedings of ICCF.

We formulate as a working hypothesis the following assumption:

- LENRs take places in open systems in which all frequencies and phases coordinated according to the universal resonance synchronization principle - the main reason for poor reproducibility. Poor reproducibility and unexplained results do not mean that the experiment is wrong.

2.2. The Bound State β -Decay

Bound state β^- decay (β_b), in which the decay electron remains in an electron bound state of the daughter atom and the monochromatic antineutrino carries the total decay energy Q , was first predicted by R. Daudel, M. Jean, and M. Lecoine [38] in 1947 and discussed in [39-43].

This new decay mode, the bound state β^- decay, was for the first time experimentally observed for bare ^{163}Dy [44] (Bare means that the atom ^{163}Dy is ionized fully. We will use the designation for this case as $^{163}\text{Dy}^{66+}$) and ^{187}Re [45]. Nuclei ^{163}Dy are stable as a neutral atom ($Q_\beta = -2.565 \text{ keV}$) and become radioactive when fully ionized atoms (bare nuclei $^{163}\text{Dy}^{66+}$) decay to $^{163}\text{Ho}^{66+}$ ($Q_{\beta_b}^K = +50.3 \text{ keV}$) via the bound state β_b decay with a half-life of 47 days. Nucleus ^{163}Ho is unstable and it is transferred to ^{163}Dy by electron capture with a half-life of $4.6 \cdot 10^3 \text{ yr}$. Difference of masses $m(^{163}\text{Ho}) - m(^{163}\text{Dy}) = 2.6 \text{ keV}$, therefore, the electron capture is only possible from M- or higher orbits. Unstable nuclei ^{163}Ho become practically stable due to ionization of atoms ^{163}Ho up to these orbits because the electron capture in these cases is only possible from continuum states which have an extremely small probability. The ionization of atoms changes the beta decay direction of nuclei: in neutral atoms ^{163}Ho (^{163}Dy) the electron capture leads to the transition $^{163}\text{Ho} \rightarrow ^{163}\text{Dy}$ (^{163}Dy are stable), in fully ionized atoms bare nuclei $^{163}\text{Ho}^{67+}$ ($^{163}\text{Dy}^{66+}$) are stable (unstable).

- General conclusion: in neutral atoms the some ground state nuclei decay via orbital electron capture, for bare nuclei (fully ionized atoms) the electron capture branches are blocked. In these cases (if in addition the positron decays are lacking) bare nuclei became stable. This conclusion is very strong and wellknown in nuclear society.

For neutral $^{187}\text{Re}^{0+}$ only a unique, first forbidden transition to the ^{187}Os ground state is energetically possible. The small matrix element and the small Q_β value of $Q_\beta = 2.663(19) \text{ keV}$ lead to the long half-life of 42 Gyr. The measured half-life [45] for bare $^{187}\text{Re}^{75+}$

($Q_\beta^K = +72.97 \text{ keV}$) of $T_{1/2} = (32.9 \pm 2.0) \text{ yr}$ is billion times (BILLION-9 ORDERS of MAGNITUDE) shorter than that for neutral ^{187}Re .

- The ground state β -decay (orbital electron capture) properties of nuclei cardinaly change when all electrons of the atomic shells are removed: stable (un-

stable) nuclei become unstable (stable) and a half-life may decrease up to billion times - 9 orders of magnitude. The interpretation is very simple: magnitude of Q_β ($T_{1/2} \approx A Q_\beta^{-5}$) and phase volume increase for the ionized atoms rather than for neutral ones and it is evident that the Pauli principle plays a different role in neutral and fully ionized atoms.

2.3. Nuclear Decay of Coulomb Excited and Isomeric States for Fully Ionized Atoms

The half-lives of isomeric states of fully ionized $^{144m}\text{Tb}^{65+}$, $^{149m}\text{Dy}^{66+}$ and $^{151m}\text{Er}^{68+}$ were measured [46]. The increase was observed of the half-lives of bare isomers by factors of up to 30 to their neutral counterparts. The authors [46] give the correct and evident interpretation of experimental results:

- This is due to the exclusion of the strong internal conversion and electron-capture channels in the radioactive decay of these bare nuclei.

Experiments with highly -ionized $^{57}\text{Fe}^{q+}$ ($q = 19 - 25$) projectiles at 6 MeV [47] and $^{125}\text{Te}^{q+}$ ($q = 46 - 48$) projectiles at 27 MeV/u [48] have demonstrated a growth (ranging from a few 10% up to 670%) of nuclear half-lives of Coulomb excited levels due to the direct influence of the electronic configuration on the internal-conversion coefficients.

2.4. The Effect of Host on the Half-life of ^7Be

Norman E.B. et al. [49] measured ^7Be decay rates in gold (Au), graphite, boron nitride and tantalum (Ta). Among these materials, they found that the ^7Be half-life was the longest in Au and the shortest in graphite. According to their experiments, the decay rate of ^7Be in Au is lower than that in graphite by $(0.38 \pm 0.09)\%$.

Ray A. [51] measured the difference of ^7Be decay rates in Au and Al_2O_3 and found that the decay rate in Au was lower than that in Al_2O_3 by $(0.72 \pm 0.07)\%$.

Ray A. et al. [50] pointed out that the apparent disagreement between the two sets of experimental results was most likely due to the choice of different reference samples with which

the comparisons were carried out. Indeed, Norman E.B. et al. [49] used the ^7Li beam for their implantation studies, whereas Ray A [51] used the proton beam. The radiation damage by ^7Li on gold lattice sites, where ^7Be nuclei stop, would be much larger [52] ($3 \cdot 10^{-4}$ vacancies/Angstrom/ion) than the corresponding damage (10^{-5} vacancies/angstrom/ion) for proton. Therefore, the radiation damage effects on lattice due to heavy ion irradiation might also be partly responsible for apparent discrepancies. It means that to speak about reproducibility in this case we should take into account at least atomic physics effects that are usually ignored.

The ratio of L to K -shell electron capture in ^7Be bare nucleus shows [53] that the measured ratio is less

than half of the existing data for free ^7Be .

- These discrepancies are most likely due to the distortions of L and K -shell orbitals by the host medium.

2.5. Controlled Gamma-Decay of Excited Nuclei

According to the modern theory, the spontaneous gamma-decay of excited nuclei in free space without any material bodies is a uncontrolled process. Probability A_{eg} of this decay

$$A_{eg} = \frac{1}{\tau} = \frac{4\pi^2\omega_{eg} |\vec{d}_{eg}|^2 \rho(\omega_{eg})}{3\hbar} = \frac{4\omega_{eg}^3 |\vec{d}_{eg}|^2}{3\hbar c^2}$$

is fully determined by the matrix element $|\vec{d}_{eg}|$ of the nucleus dipole moment and energy of the nuclear transition $\hbar\omega_{eg} = E_e - E_g$.

The total lifetime $\tau_{tot} = \tau/(1 + \alpha)$ and radiative lifetime τ of this excited nucleus in free space are the constants. Here α is the coefficient of internal electron conversion for the nuclear transition $E_e - E_g$.

Problems become very complicated in the important case when material bodies are present in the surrounding space. Vysotskii V.I. [54] considered the general system which included the

excited atom nucleus, the system of atom electrons, the system of zero-energy (in vacuum state) electromagnetic modes, and the screen — the system of N resonant or nonresonant atoms situated at the distance $d \gg \lambda_{eg} = 2\pi c/\omega_{eg}$. The authors of [55] concluded that

- It is usually stated that in all cases with the presence of any material bodies at a macroscopic distance $d \gg \lambda_{eg} = 2\pi c/\omega_{eg}$ from the excited nucleus the expression for the lifetime τ and τ_{tot} remains the same or changes by an unmeasurable small value. Such a supposition is erroneous. It was shown [54] that a spontaneous gamma-decay was a process of an excited nucleus relaxation, the phase promise of which was caused by interaction with a fluctuating state of the thermostat at the distance $d \gg \lambda_{eg}$ from the nucleus. The phenomenon of a controlled nucleus gamma-decay is a result of interaction of the nucleus with zero-energy modes, interaction of these modes with the atoms of controlled (and controlling) screen, and interaction of the nucleus with the system of atom electron.

The increase in radiative lifetime τ of an excited nucleus by 10 – 40% and total lifetime τ_{tot} by 1% was observed in the experiments [55–57] with gamma-source ^{57}Co ($^{57*}\text{Fe}$) and with gamma-absorber made of stable ^{57}Fe isotope. So these results prove the possibility of controlled essential influence of a thin resonant screen on the amplitude, space and temporal characteristics of a spontaneous decay and excited nuclei radiation.

2.6. Okorokov Effect

Let us consider the interaction of an incoming particle (atom or nucleus having the ground state E_g and the excited state E_e) with the crystal target. It is possible to choose the conditions [58, 59] when the frequency of a collision particle with the atoms of crystal $\nu_{col} = V_0/a_0$ (the velocity V_0 of a particle motion a_0 is the distance between the atoms in the crystal) will be commensurable with the transition frequency ν_{tr} of the particle

$$\nu_{tr} = \frac{E_e - E_g}{h} = \frac{n_1}{n} \nu_{col},$$

where n_i - integer numbers. It is clear that at such conditions the interaction between the particle and atoms of the crystal should have a resonance character.

If the particle interacts with the n atoms of the crystal, then the probability to excite the particle is equal to

$$W(n) = W(1) n^2,$$

where $W(1)$ is the probability of excitation of the particle by one atom of the crystal.

This is a collective (coherent) amplification mechanism of the excitation for the projectiles in the periodic field of the crystal predicted first by Okorokov V.V. [58, 59] and observed experimentally by Okorokov V.V. too [60-62].

The resonance and coherent amplification of atoms and nuclei excitations by the periodic fields of crystals is now well established and recognized by the physical society and is used in different applications but is not known for the cold fusion society.

From a modern point of view water has a very complicated geometrical structure as a collection of quasicrystal clusters (see [63] and references in it). The hydrogen atom, atoms and molecules, water and solutions, solid states and condensed matter have the same homology in the geometric structure, where the de Broglie wave length of electron in the ground state of hydrogen atom plays the role of the standard one [64].

The puzzle of poor reproducibility of experimental data of LENR is now evident:

- Electrolysis in solutions, discharge in gases, and any external influence on atoms lead to:

1. The atoms are ionized, thus changing radioactive rates by bound state β_b -decay of nuclei.
2. The ions can be accelerated in a such way that they come to resonance conditions to intensify excitation of nuclei, atoms, ...
3. Even small external fields can induce large responses as an avalanche in the mountains is stimulated, say, by an accident cry.

A mechanical analogue of the observed phenomenon is the synchronization of oscillations of the pendulum

clock suspended from the moving girder - the Huygens synchronization principle [65]. The universal resonance synchronization principle for a microsystem (for nuclei, atoms, molecules for living and nonliving cells, ...) was established in [66].

The decrease and increase radioactivity of tritium with increasing temperature in small titanium particles was observed [67] whereas that current experiment and theory overlooked this effect.

2.7. Nuclei and Atoms as Resonators

In 1953 Schwartz H.M. in 1953 [68] proposed the nuclear and the corresponding atomic transitions be considered as a unified whole process. This process contains the β -decay which represents the transition of nucleon from one state to another with emission of electron and antineutrino, and simultaneously the transition of atomic shell from the initial state to the final one. A complete and strict solution of this problem is still waiting for its time (see, for example, a review paper [69]).

The division of decay energy into nuclear and atomic energies has only a conditional sense, especially, in the resonance case. The process has a resonance character and its probability is large when energy differences of nuclear and atomic transitions become close to zero. The drastic acceleration of decay time in H -like ions of ^{229m}Th may be up to 10^5 [69], the electron shell serves as a trigger, reducing the lifetime of the isomer by up to five orders of magnitude. The fantastic acceleration of decay time for the case 76-keV E3- transition in ^{235}U may be up to 20 orders of magnitude.

The probability of the resonance transfer of energy by electrons from the nuclei can be increased by application of laser, which compensates the defect of resonance. The corresponding enhancement factor in some cases may be 10^3 . It is important to note that the knowledge of isomer energy is not necessary, the laser should be synchronized on the atomic frequency.

- This is a real phenomenon of resonance synchronization (see Appendix) of nuclear, atomic, and laser frequencies to control the decay processes.

It is also predicted [70] that the lifetime of the hindered photo-fission can be reduced up to $10^3 - 10^4$ by application of laser. Laser in a such case changes the angular momentum of a decaying state by unity practically without altering its energy.

- Low-energy external fields in LENR can play a role of a trigger changing the quantum numbers of the hindered or forbidden processes so that the first should be enhanced and the second should be allowed. This mechanism inducing LENR may be the main reason for poor reproducibility of LENR experiments and main mechanism of geo- and biotransmutations.

2.8. Geo-, Bio- and Alchemical Transmutations

All the above-described mechanisms of LENR are grounded on the universal resonance synchronization principle (see Appendix). The main requirement of this principle is that the frequencies $\nu_i(ext)$ of external fields should be commensurable with the frequencies $\nu_j(in)$ of subsystems making a whole system: $\nu_i(ext) = \nu_j(in) n(j)/n(i)$. We strongly emphasize that the frequencies of an external field can be infinitely small in comparison with the corresponding frequencies of subsystems. The frequencies $\nu_i(ext)$ are as triggers starting emission of internal energy. The enhancement (resonance) effect on LENR induced by external fields can be extremely large (small) when maximal values of density distributions for external fields and the corresponding distributions of a subsystem coincide (do not coincide). It means that:

- Even extremely low-energy external fields may induce nuclear transmutations with emission of internal high energies, according to the universal resonance synchronization principle.

Natural geo-transmutations in the atmosphere and earth occur at the points of strong change in geo- and electromagnetic fields [71-73]. V.I. Vysotsky and A.A. Kornilova published an excellent book: “Nuclear Fusion and Transmutation of Isotopes in Biological System” [74], we refer a reader to this book.

It seems (for F.A.Gareev) that the fact that some alchemists may [75] “change base metals into noble ones, silver or gold” does not contradict mechanisms of LENR described above.

2.9. Ball lightning as a macroscopic low energy nuclear reactor

All internal contradictions of the previous theories of a ball lightning were based, by default, on an assumption that the ball lightning is a plasmoid. In order to maintain the macroscopic volume of air (the mixture of nitrogen, oxygen, water vapour, etc.) in ionized condition, it is necessary to provide a great amount of energy from some kind of a source. Many experimenters, among them are such well-known experts as P.L. Kapitsa, made repeated attempts to create a long-living spherical plasmoid in laboratory conditions. However, no efficient ways of supplying the isolated plasma clots with energy and maintaining them in a stationary condition for a few minutes (that is the lifetime of a natural ball lightning) could be found.

The purpose of this paper is to substantiate a hypothesis that the natural ball lightning is an area of space where the chain nuclear reaction of the bound-state β -decay of radioactive phosphorus nuclei takes place. It is shown that the analyzed phenomenon is related to the physics of electrical discharge in gases in-

directly. Therefore, the term globular lightning is not sufficiently correct.

The main hypothesis which is asserted hereinafter was formulated for the first time in [76]. The logic of the creation of this hypothesis is as follows:

1. Ball lightning always leaves a smell of sulphur, ozone and nitrogen oxide after itself [77].
2. Sulphur can be generated only as a result of phosphorus β -decay [78].
3. Rate constant of β -decay depends on a lot of the ionization degree of decaying radionuclide [33]. The half-life of ionized radiophosphorus is approximately 1-2 minutes and is comparable with the lifetime of ball lightning in natural conditions.
4. Radiophosphorus is abundant in nature. It is found in rain-water in macroscopic amounts [79].

This model was proved in [76] and we can say that it is now confirmed. Thus, ball lightning is a type of a natural low-energy nuclear reactor.

2.10. Demkov and Meyer super-focusing

The ion flux transmission through a monocrystalline medium is accompanied by many interesting and unexplained phenomena (see a review papers [93,94]). Among them we indicate the effect of “channeling” in crystals: the enhancement and reduction of flux near crystallographic directions.

Yu.N. Demkov and J.D. Meyer [95] propose to use a “channeling” effect in the stimulation and enhancement of LENR by following way:

“A highly collimated beam of protons (≈ 1 MeV) entering the channel of a monocrystal film forms at a certain depth an extremely sharp (≈ 0.005 nm) and relatively long (some monolayers of the crystal) focusing area where the increase of the flux can reach thousand times. Impinging atoms in this focusing area can undergo nuclear reactions with proper foreign dopants which disappear if the crystal is tilted from this position by only 10^3 radians. This effect can be called super-focusing in the channels, in contrast to the ordinary flux peaking where the increase of flux reaches only few times. Results are confirmed by the Monte Carlo calculations accounting for several properties of the real lattice.”

3. Conclusions

We have concluded that LENR is possible in the framework of the modern physical theory - the universal resonance synchronization principle and based on its different enhancement mechanisms of reaction rates are responsible for it². Investigation of this phenomenon requires the knowledge of different branches of science:

²Intensification of LENR using superwave excitation [80] is based on this principle.

nuclear and atomic physics, chemistry and electrochemistry, condensed matter and solid state physics, The results of this research field can provide a new source of energy, substances and technologies.

The puzzle of poor reproducibility of experimental data is due to the fact that LENR occurs in open systems and is extremely sensitive to parameters of external fields and systems. Poor reproducibility and unexplained results do not mean that the experiment is wrong³.

APPENDIX

A.1. The Universal Resonance Principle of Synchronization

Many objects in Nature - elementary particles, nuclei, atoms, molecules, . . . , DNA, proteins, etc. are built as self-consistent hierarchical systems and have the same homological constructions in the sense that they are found by the same fundamental physical laws: energy-momentum conservation law and sectorial conservation law (the second Kepler law). Schrodinger [81] wrote that an interaction between microscopic physical objects is controlled by specific resonance laws. According to these laws, any interaction in a microscopic hierarchic wave system exhibits the resonance character. The difference between eigenenergies (eigenfrequencies) in one system should be equal to each other

$$h\nu_1 - h\nu'_1 = h\nu'_2 - h\nu_2, \quad \nu_1 - \nu'_1 = \nu'_2 - \nu_2 h. \quad (1)$$

Therefore, eigenfrequencies are additive. In other words, the resonance condition is formulated in the following way: oscillations participating in an interaction process should be constituents of the same frequencies. Thus, we come to the important conclusion: in the whole interacting self-consistent wave system the hierarchy of frequencies is established. So the sum of all partial frequencies is the integral of motion. Due to the above-said, the corresponding partial motions are determinate. This determinism arises as a consequence of the energy conservation law. As the resonance condition arises from the fundamental energy conservation law, the rhythms and synchronization of the majority of phenomena to be observed are the reflection of the universal property of self-organization of the Universe. The resonance synchronization principle is substantiated at the microscopic level (see, for details [82]) as the consequence of energy conservation law and resonance character of any interaction between

wave systems. In this paper, we have demonstrated the universality of the resonance synchronization principle independent of substance, fields and interactions for microsystems. Thereby, we bring some arguments in favor of the mechanism - ORDER BASED on ORDER, declared by Schrodinger in [83], fundamental problem of contemporary science. We come to a conclusion [84] that a stable proton and a neutron play the role of a standard for other elementary particles and nuclei. They contain all necessary information about the structure of other particles and nuclei. This information is used and reproduced by simple rational relations, according to the fundamental conservation law of energy-momentum. We originated the principles of commensurability and self-similarity [85]. The commensurability and self-similarity result in the very unity of the world. The principle of commensurability is displayed in phenomena in different branches of science [85].

All material objects (micro- and macrosystems), which are described by standing waves, know all about each other. Each object is the scaled one of the other and it is not possible to say which is more "fundamental". In this work, we have demonstrated that the structure of DNA and cell molecules can be calculated with some structure of a hydrogen atom. The interatomic distances in cell molecules are quantized according to the quantization rule of the fractional Hall effect. Therefore, we can conclude that the structure of DNA and cell molecules can be established from the analysis of hydrogen spectra using the quantization rule of the Hall effect and vice versa [86]. The bridge between the structure of a hydrogen atom, cell molecules and the Hall effect exists! It is very surprising that there are phenomena in Nature that are really described by simple rational relations. Only the fundamental conservation law of energy - momentum is responsible for this harmonic movement.

The resonance principle of synchronization became a fruitful interdisciplinary science of general laws of self-organized processes in different branches of physics. It is intriguing to speculate that many questions can now be formulated as a result of universality of the resonance synchronization principle independent of substance, fields, matter and interactions for micro- and macrosystems [86]. Information concerning important details of an ecosystem's evolution is contained in frequency spectra. Therefore, matter turns out to be a form of organized information. The Universe was arranged according to number, harmony, and perfect forms.

A new concept in evolution is robustness. One suggests simulating evolution of complex organisms constrained by the sole requirement of robustness in their expression patterns. Robustness in biophysics is defined as the ability to function in face of substantial changes in components. Robustness is implemented by constraining subsequent patterns to have similar expres-

³Solutions of salts, electrolytes and living systems contain a large amount of ions. In these cases, the bound state β_b -decay and other described above enhancement mechanisms of LENR can play an essential role. Unfortunately, we do not know the works devoted to this problem.

sion patterns. Key properties of biochemical networks are robust, i.e., they are insensitive to precise values of the biochemical parameters [87]. Robustness is an important ingredient in simple molecular networks and, probably, also an important feature of gene regulation. S. Bornhold and K. Sneppen [88] suggest considering robustness as an evolutionary principle. We came to the conclusion that the robustness principle can be understood in the framework of the universal resonance synchronization principle.

We have concluded that the homology of atom and molecule structures exists. It means that the de Broglie wave length λ_e of electron in the ground state of a hydrogen atom plays the standard role - all interatomic distances in molecules could be commensurable with λ_e . There are huge examples of commensurable ratios between the interatomic distances and λ_e in superconducting, nanomaterials, DNA, protein, ..., living molecules [86].

A molecule is an aggregate of atoms in a distinct three dimensional arrangement. Distances between atoms fix the structure of the molecules, as was so forcefully emphasized by L.

Pauling. These interatomic distances depend on the resonance interactions between atoms and also on the sizes of atoms. We come to the conclusion that each object in the hierarchical system

is scaled one of the other and it is impossible to say which is more "fundamental". We assume now, as a working hypothesis, that the De Broglie electron wave length in a hydrogen atom in the ground state can be considered as a standard of dimensions for atoms and interatomic distances in molecules. So interatomic distances and radii of atoms can be written in the following way:

$$R = \frac{n_1}{n_2} \lambda_e, \quad (2)$$

where $\lambda_e = 0.3324918 \text{ nm}$ is the de Broglie electron wave length in a hydrogen atom in the ground state and $n_1(n_2) = 1, 2, 3, \dots$

• Note that the quantization conditions for the fractional Hall effect [86] are the same as (2). It means that the fractional Hall effect demonstrates only the commensurable velocities of electrons in hydrogen atoms and *GaAs*-type heterostructures (two-dimensional electron gas). So there is no room for interpretation of the fractional Hall effect in terms of the fractional charge. Nobody observed the fractional charge in Nature.

It is well known in optics (in quantum mechanics too) that the transition coefficient of light through the layer is equal to one if the following relations between the thickness R of the layer and wave length λ_e exist

$$R = \frac{n}{4} \lambda_e, \quad n = 1, 2, 3, \dots \quad (3)$$

It is interesting to note that:

1. the Bohr quantization conditions $\lambda_N = N\lambda_e$ for a hydrogen atom and the quantization conditions $\lambda_N = N\lambda_{4He}$ for superfluid 4He coincide with (3) if $N = n/4$;
2. the Tomasch quantization conditions for tunneling are the same as (3).

We have carried out a systematic analysis of interatomic distances for a huge number of systems, using (3), in which $\lambda = \lambda_e$ is the electron wave length in the ground state of a hydrogen atom. We came to the conclusion that the superconductivity can be explained by the assumption: channel motions in systems like that and electron motion in the ground state of a hydrogen atom are exactly synchronous. Therefore, superconductivity systems represent a coherent synchronized state - complex of coupled resonators with the commensurable frequencies.

• It means that we have in principle found out the possibility to achieve super-conductivity at room temperature [86].

The parameter-free formula for interatomic distances in biomolecules, superconductors, and size of nanostructures has been obtained. This establishes some bridge between the structures of different phenomena (conductivity, superconductivity, insulator-metal transmission, quantum Hall effect, superfluidity, quantization of nanostructure cluster size, size of biomolecules). This connection can be considered as an indication of existence of some physical phenomena in the structures of the superconducting and living systems.

We have shown [86] only a small part of our calculations by formula (3) and the corresponding comparison with experimental data for interatomic distances in some molecules. One can be surprised by a high accuracy description of the existing experimental data.

Understanding of the origin and evolution of the genetic code must be the basis for a detailed knowledge of the relationship between the basic building blocks of DNA and environment. As is widely accepted today, essentially all the DNA in an eukaryotic nucleus are formed of histones and different chromatin structures folded hierarchically. At least five orders of DNA and chromatin organization and folding (nucleotide, helix, nucleosome, solenoid, and chromatin fibre loop) have been described in literature. A DNA chain is a long unbranched polymer composed of only four types of subunits. These are nucleotides containing the basis adenin (A), cytozine (C), guanin (G), and thymine (T). These nucleotides form complementary flat pairs and the distances between these plains are equal to λ_e .

• It means that the structures, formed in DNA molecules by nucleotides, produce the two- and three-dimensional waveguide.

All proteins look like dimers in which the two copies of the recognition helix are separated by exactly one

turn of the DNA helix: $3.4 \text{ nm} \Leftrightarrow 10\lambda_e = 3.325 \text{ nm}$.

The DNA is packaged with histones into regularly repeating nucleosomes that are packed into 30 nm (it's diameter) fibers; $30 = 90\lambda_e = 29.92 \text{ nm}$, it is also elaborated, folded, and organized by other proteins into a series of subdomains of distinct character. This higher-order packing is the most fascinating and also most poorly understood aspect of chromatin.

Molecules of DNA, amino acids, proteins, ... contain tetrahedral blocks $H_3C - C$ with the angles $< HCH = < HCH = 109.47^\circ$, with the bond length $3d(H - C) = \lambda_e = 0.3325 \text{ nm}$ and $3d(H - C) + d(C - C) = 3/2\lambda_e = 0.4987 \text{ nm}$. Note that these molecules of amino acids and DNA have planar blocks $H_2N - C$, whose bond length is equal to $2d(H - N) + d(N - C) = \lambda_e = 0.332 \text{ nm}$. Pentagonal rings in adenine and guanin have the bond length equal to 0.668 nm and 0.666 nm , respectively, which is close to $\lambda_e = 0.665 \text{ nm}$.

Many distances in living molecules are commensurable with the de Broglie wave length λ_e of an electron in the ground state of a hydrogen atom. This means that λ_e play the role of the standard distance in molecules, especially in living molecules. Hence, the electron motions in a hydrogen atom and in living molecules are synchronized and self-consistent.

M. Gryzinski [90, 91, 92] has proved that atoms are the quasi-crystal structure with definite angles: 90° , 109° and 120° , which are the well-known angles in crystallography.

- We have proved the homology of atom, molecule and crystal structures.

So the resonance synchronization principle is substantiated at the microscopic level as the consequence of the energy conservation law and resonance character of any interaction between wave systems. The commensurability and self-similarity result in the very unity of the world.

It means that our method can be used in different fields of fundamental researches and also in applications: construction of new materials, say, high-temperature superconductors, new drugs in medicine, new methods in diagnostics of diseases, and new devices by analogy with biomolecules.

A.2. Atoms as open systems

The conservation laws fulfill for a closed systems. Therefore, the failure of parity in week interactions means that the corresponding systems are the open systems. Periodic variations (24 hours, 27, and 365 days [21-25]) in β -decay rates indicate that failure of parity in week interactions have a cosmophysical origin.

The charged particles moving with acceleration should radiate (absorb) electromagnetic waves - the fundamental classical electrodynamics law. The stable

orbits of electrons in atoms are exist, but electrons do not radiate on them according to third Bohr's postulate (third Bohr's postulate in 1913 - "Despite the fact that it is constantly accelerating, an electron moving in such an allowed orbit does not radiate electromagnetic energy. Thus, its total energy E remains constant. "). Why electrons do not radiate on the stable state of atoms - nobody knows it. We formulate as a working hypothesis the following assumptions:

- The classical laws of physics are valid for macro- and microsystems. Contradiction between classical electrodynamics and quantum theory should be solved a very simple way. Proton and electron in hydrogen atom move with the same frequency, their motions are synchronized. A hydrogen atom represents radiation and accepting antennas (dipole) interchanging of energy with the surrounding substance. This energy is the relict radiation energy.

- The relict radiation ($T=2.725 \text{ K}$) should play a role of conductor for proton and electron motions in the hydrogen atom due to the universal resonance synchronization principle. The external field - relict radiation field and hydrogen atom form an auto-oscillation system in which the frequencies of an external field and frequencies of the whole subsystem are commensurable. The demand for frequency commensurability means that all motions are in a co-ordination (in resonance).

- The sum of radiate and absorb energies by electron and proton moving in an allowed orbit is equal to zero. **THUS, ITS TOTAL ENERGY E REMAINS CONSTANT** - only the last part of the third Bohr's postulate is correct.

- The relict radiation is a result of the selforganization of stable hydrogen atom according to the universal resonance synchronization principle.

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