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On observations of the new global anisotropy force action in the geo- and astrophysical phenomena

Yuriy Alexeevich Baurov[1, 2], Igor Fedorovich Malov[3], Francesco Meneguzzo[4]

[1]Closed Joint Stock Company Research Institute of Cosmic Physics, 141070, Moscow Region, Pionerskaya, 4, Korolyov, Russia
[2]Hotwater Srl, , Via Gioberti, 15, I-56024 San Miniato (PI), Italy
[3]P. N. Lebedev Physical Institute, Russian Academy of Sciences, 117924, Leninski pr., 53, Moscow, Russia
[4]National Research Council – Institute of Biometeorology, Via Caproni, 8, I-50145 Firenze, Italy

Email address:

baurov@mail.ru (Y. A. Baurov), malov@prao.ru (I. F. Malov), f.meneguzzo@ibimet.cnr.it (F. Meneguzzo)

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Abstract: To the foundation of a principally new short-term forecasting method there has been laid down a theory of surrounding us world's creation as a result of interaction of byuons – discrete objects (Byuon theory, shortly BT). The definition of the byuon contains the cosmological vector-potential A_g - a novel fundamental vector constant. BT predicts a new non-gage anisotropic interaction of nature objects. The 100% probability of an strong earthquake arises when in the process of the Earth rotation the zenith vector of a seismically dangerous region and/or the vectorial potential of Earth's magnetic fields are in a certain way oriented relative to the vector A_g. In the paper it is shown a connection between the vector A_g direction and directions of pulsars motion, an arising of tornados, and anisotropy of cosmic rays. The vector A_g has the following coordinates in the second equatorial coordinate system: right ascension $\alpha \approx 300° \pm 15°$ ($20^h \pm 1^h$), declination $\delta \approx 36° \pm 10°$. It is shown that some problems connected with dark matter (DM) and dark energy (DE) can be solved in the framework of BT. Physical space in our Universe is the quantum medium of special objects 4b (BT), formed in four-contact interactions of byuons ($m_{4b}\, c^2 \approx$ 33eV). These objects determine the average density of substance (DM) in the Universe~10^{-29}g cm^{-3}. The new force can cause the observed acceleration of Galaxies in our Universe. The estimations show that it is higher than the gravitational force at distances of order of$10^{26} – 10^{28}$cm.

Keywords: Byuon Theory, Global Anisotropy, New Force, Earthquakes, Tornadoes, Pulsars, Cosmic Rays, Dark Matter, Dark Energy

1. Introduction

In [1-3] theory of surrounding us world's creation and of physical space as a result of interaction of byuons – discrete unobserved objects, is given (Byuon theory -BT). The definition of the byuon contains the cosmological vector-potential A_g - a novel fundamental vector constant. This theory predicts a new non-gage anisotropic interaction of nature objects. Peculiar "tap" to gain new energy (giving the arising of an earthquakes and many astrophysical phenomena) are elementary particles because a fraction of their masses are proportional to the modulus of some summary potential A_Σ that contains potentials of all known fields. The value of A_Σ cannot be larger than the modulus of A_g ($1.95 \cdot 10^{11}$ G cm). In accordance with the experimental results shown in [1-9], this force ejects substance from the area of the weakened A_Σ along a conical formation with the opening of $100^o \pm 10^o$ and the axis directed along the vector A_Σ. This vector has the following coordinates in the second equatorial coordinate system: right ascension $\alpha \approx 293° \pm 10°$, declination $\delta \approx 36° \pm 10°$ [3,4]. The analysis of astrophysical phenomenon can define more exactly the direction vector A_g.

In [3,10] using the hypothesis for connection of the Earth's seismic activity with fluctuations in the structure of physical space (vacuum) is considered. That is, our planet, the Earth, will be treated as a peculiar large-scale probe in the physical space the seismic activity of which allows to judge the fluctuations of physical space itself and in so doing to refine its structure and direction of the vector A_g. And vice versa, with a knowledge of space structure and of its fluctuations one would be able to predict more accurately the most dangerous day time for Earth's inhabitants at one or another

place of our planet. The urgency of this problem is obvious because earthquakes claim many-thousand victims and catastrophic destructions. A similar argument exist for tornadoes: results clearly point to a very significant link between the angle formed by the vector A_g and the surface tangent to the local Earth's surface, on one side, and the occurrence of the most energetic tornadoes on the other, as shown in [11].

Results from studies of a global anisotropy of physical space and new interaction in nature based on analyzing motion of pulsars and anisotropy of cosmic rays, are presented in [12-15].

In [16] it is shown that some problems connected with dark matter (DM) and dark energy (DE) can be solved in the framework of the BT. Physical space in our Universe is the quantum medium of special objects 4b, formed in four-contact interactions of byuons ($m_{4b}c^2 \approx 33$eV). These objects determine the average density of substance DM in the Universe ~10^{-29}g cm^{-3}. The new force can cause the observed acceleration of Galaxies of our Universe due to the DE [16]. The estimations show that it is higher than the gravitational force at distances of order to 10^{26}–10^{28} cm. Some other consequences of the byuon theory are considered in [16] too.

The present article is devoted to the universal anisotropic property of the physical space and new non-gauge interaction in nature in a wide range of dimensions based on analyzing earthquakes [4,10], arising of tornados (sizes about $10^1 - 10^9$ cm) [11], motion of pulsars [4, 12-15] (size of our Galaxy (10^{22}cm) and anisotropy of cosmic rays up to ultrahigh energies [15,17] (size of our Universe 10^{28} cm) and the connection of BT with problems about DM and DE [16].

2. Earthquakes and Mechanisms of their Generation

An earthquake is the sudden release of potential energy of bowels of the Earth in the form of shock waves and elastic vibrations propagating every which way from the center (hypocenter), as well as in the form of shifts of the Earth's surface such as warpings of crust, displacements along fault lines, compactions of granular or not grouted precipitations, soil slips and mudflows, soil dilution, snow avalanches, new fracture formation in rocks [10].

The mechanism of release of potential energy is not yet sufficiently studied for earthquakes at depths from 60km to 720km [18, 19].

The Earth is never quiescent. Sensible seismographs detect constantly weak oscillations, microseisms, with periods from 4 to 6 seconds and variable amplitudes. Even "microseismic storms" take place, they are connected mainly with sharp changes in weather. During powerful earthquakes almost total seismic energy is released.

The magnitude is characterized by the maximum amplitude of record by a seismograph of standard type at a fixed distance from the hypocenter of earthquake. The most potent disastrous earthquakes have amplitude M = 9. As an example of earthquakes with M = 9, that in Lisbon on November 1, 1755, may be considered.

Any earthquake with M≥7 is a great disaster, particularly if that happens in the neighborhood of a populated area. The energy released during such earthquakes ranges from $2.1\cdot10^{22}$ to $1.6\cdot10^{25}$ erg.

Let us analyze the seismic activity of the Earth in the context of action of the new force.

Peculiar "taps" to gain new energy for seismic activity are elementary particles because the fraction of their masses are proportional to the modulus of some summary potential A_Σ that contains potentials of all known fields [1-3]. The new force is of nonlinear and non-local character as to variation of some summary potential A_Σ and may be represented by some series in ΔA_Σ [1-3, 9].

The expression for the new force takes the form:

$$|\vec{F}| = -2Nm_0 |\vec{A}_g| \cdot c^2 \lambda(\Delta A) \cdot \frac{\partial \lambda(\Delta A)}{\partial \Delta A} \cdot \frac{\partial \Delta A}{\partial X_1} \qquad (1)$$

Here N is the number of stable elementary particles in the body (electrons, protons and neutrons).

Note that expression for the new force (1) is local (we cannot deal with the nonlocal ones as yet), therefore, to account for the non-locality of the phenomenon, we will take ΔA equal to the difference in changes of the summary potential $|\vec{A}_\Sigma|$ at the location points of a test body and a sensor element [1-3].

These changes being equal, the force will be absent. Depending on the relative position of the sensor and the test body, ΔA can take either a positive or a negative value.

The analysis of the specific experimental results with high field magnets (see [1-3, 6-9]) has led to the following expression for $\lambda(\Delta A)$:

$$\lambda(\Delta A) = \sum_{k=1}^{\infty} \lambda_k \exp\left\{ -\left[\frac{\Delta A}{A_G} \cdot \frac{r}{\Delta y} \cdot \left(\frac{ct^*}{x_0} \right)^{3/2} \right]^k \right\} \cdot \Delta A^k \qquad (2)$$

Here r is the radius of the circle where the test body is located on; Δy is the difference in coordinates y of the sensor and the test body [1-3]; $(x_0/ct^*)^{3/2}$ is the part of energy $2m_{\nu_e}c_0^2 = 2m_0|\vec{A}_G|c_0^2$, which can be acted upon by the electromagnetic field potentials.

Using the linear term only in the expression of (2) by ΔA, we obtain the following formula for the modulus of the new force:

$$F = 2Nm_\nu c^2 \lambda_1^2 \cdot \Delta A_\Sigma \, (\Delta A_\Sigma / \Delta X) \qquad (3)$$

Consider a mechanism of increase of this force due to Earth's currents. As was said in [3,5,10], there exists in the vicinity of the Earth some real summary potential A_Σ equal to the sum of A_g and potential from magnetic fields of Galaxy, Sun, Earth, etc.

The quantity $|A_\Sigma|$ is always less than $|A_g|$ [1-3]. Huge magnitude fluctuations of vectorial potentials of magnetic sources remote from the Earth are possible, for example,

from the Sun. Despite the large values of ΔA_Σ of those sources, magnitudes of $\frac{\partial \Delta A_\Sigma}{\partial x}$ from them are, as explained in [3, 5, 10], usually quite small since variations of potentials take place through vast distances. Hence the values of the new force from remote sources are very small, too, and the values of $\frac{\partial \Delta A_\Sigma}{\partial x}$ due to currents in the Earth can be several orders greater than those from remote sources. Then the Earth might work as some amplifier of enormous fluctuations of ΔA_Σ from remote sources because the magnitude of the new force includes the product $\Delta A_\Sigma \frac{\partial \Delta A_\Sigma}{\partial x}$ where the first factor is created by remote cosmic sources and the second one is by the currents in the Earth.

Let's give an example.

In [1-3] the results of an uninterrupted experiment (from *February 24* to *March 22, 1996*) with a tide gravimeter developed in the Sternberg Astronomical Institute of Moscow State University on the base of a standard quartz gravimeter "Sodin" (Canadian production) were shown (Fig. 1, Fig. 2). In order to measure the new interaction by the Sodin gravimeter, a constant magnet (*60mm* in diameter, *15mm* in height, the field *B* in the center of *0.3T)* was attached to it in such a way that the vector-potential lines of the magnet in the vicinity of a test platinum weight were directed perpendicular to the Earth's surface (i.e. towards the vertical component of the vector $\vec{A}_g$).

The major deflections of the gravimeter, being repeated every *24 hours*, are associated with the Moon's gravity. Denote an average amplitude of Moon tide by *L*, an amplitude of accidental events, recorded by gravimeter and corresponding to an increase in Moon attraction, by $K L^+$, and that corresponding to a decrease by $K L^-$, where *K* is a factor indicating the value of deflection in terms of Moon tide amplitudes.

Three events were documented: on the *28th of February*, at 10^{05}; *4th of March*, at 10^{58}; *18th of March*, at 20^{54}. The latter two had an huge amplitude ($13.6L^-$ and $15.2L^-$, respectively) and $\Delta t \approx 10$ *min*. A time profile of the event on *18th of March 1996* is shown in Fig. 2 at a larger time scale.

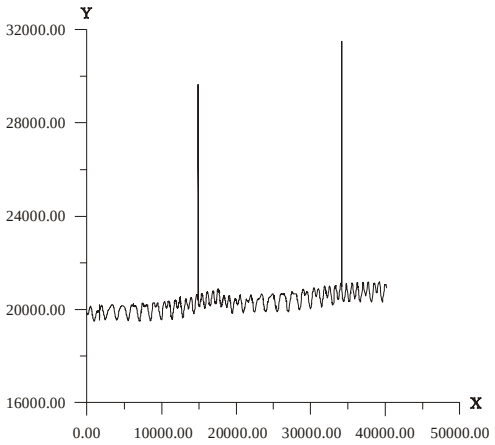

Fig. 1. *Readings of the gravimeter from Feb. 24,1996, to March 22,1996, inclusively.*

y is displacement of platinum weight. One division is 0.1 μm, or 0.2 μgal, x is time in minutes.

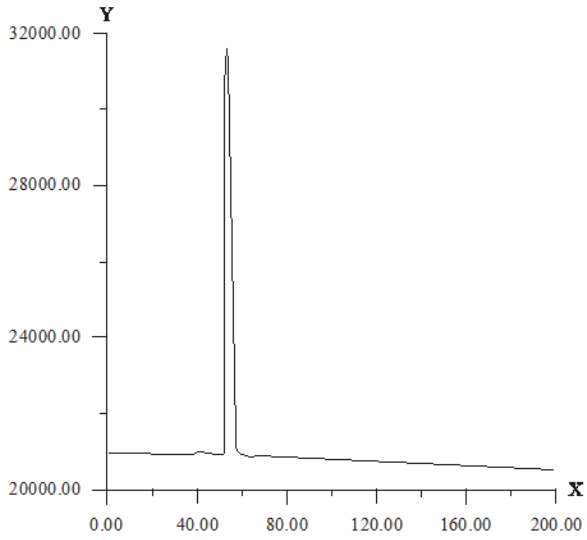

Fig. 2. *The event on March 18,1996. y is displacement of platinum weight. One division is 0.1 μm, or 0.2 μgal, x is time in minutes.*

Here ΔA was created by some natural sources, and $\frac{\partial \Delta A}{\partial x_l}$ was created by a constant magnet attached to the gravimeter, since ΔA_Σ from spatial sources varies at immensely long distances, with a very small value of $\frac{\partial \Delta A}{\partial x_l}$ at the point of the gravimeter location.

The fact of local change in the gravitation field described in [3, 10] (see Fig. 1, Fig. 2) may act as trigger for the stresses accumulated in the Earth's crust, and cause earthquakes. At that, the role of amplifier may be played, instead of a constant magnet, by the currents existing inside the Earth.

Further, the maximum mass change in a local characteristic volume of the Earth takes place when this volume passes, during Earth's rotation, through the region of maximum change in A_Σ by the vectorial potential A_E of the Earth. To estimate that, it will suffice to assume the existence of a circular current in the Earth [1-3] the magnetic field of which is observed by us as geomagnetism. Near the current, the vectorial potential of its magnetic field is directed along the vector of current. Thus if the vector A_Σ in some volume of the Earth experiences the maximum change by A_E, the masses of elementary particles in that same volume are also changed in accordance with the BT, and hence the total mass of the volume is changed, too. The latter leads to maximum change in the gravitation field of the Earth that causes earthquakes.

In [3,10] is given the dependence of distribution of $z_{\vec{A}_g}$ arcs (the arc of the great circle of celestial sphere between the direction to zenith and that to the point of intersection of A_g with the sphere) on the latitude φ of earthquake epicenters. The results of calculation show two assumed values of the α-coordinate of A_g at 270° or 290° and $\delta \approx 30°$. The full statistics of earthquakes included more than 1500 earthquakes [3, 10].

3. Method for Short-Term Earthquakes Forecasting

The analysis of collected data about strong earthquakes [3, 10] shows that practically all of them happened at the moments when a seismically dangerous region was in a certain manner oriented in space relative to the stars.

To clarify the regularity observed, consider the diagram in Fig. 3 that conveniently represents the positions of the Earth and the earthquake zone at the moment of the event (Table 1). For simplicity, the diagram is brought to the plane of the ecliptic. The Earth (globe) moves relative to the Sun (at the centre in Fig. 3) in an orbit lying on the ecliptic plane. The latter is inclined to the equatorial plane at an angle of $\varepsilon = 23°26'$ (in the diagram, the plane of the ecliptic and the rotation of the Earth around its axis are shown as circles). Eight positions of the Earth are given at the moments of earthquakes (Positions 1-8 in Table 1).

The Earth rotates around its axis, and the regions of earthquakes also move along circular trajectories relative to this axis. At the moments of earthquakes their regions were in positions 1-8. The vectors V (Positions: 1-8) of linear velocities of daily rotation of earthquake's regions as well as the vector A_g take certain positions relative to each other. (Vectors V are antiparallel to the vector potential A from the magnetic field of the Earth). Namely, if one brings the vector A_g and vector V of linear velocities, by a parallel transfer, to the point of the earthquake epicenter, then in the moment of earthquake the vectors V of circular velocities of the earthquake regions fall into the limits of a zone restricted by two conic surfaces circumscribed about the vector A_g, and are directed along the generatrices of the family of conic surfaces inside the zone in consideration. The openings of the cones forming that zone are, respectively, 90° and 110°.

The analysis of additional factors accompanying the earthquakes has shown that the seismic activity increased when the earthquakes were preceded by severe changes in the total activity of the Sun (i.e. changes in ΔA_Σ).

From the above reasoning one can indicate, with an accuracy of ± 1 hour, the time points when a seismically dangerous region will go through the most hazardous spatial directions. Whether an earthquake will happen or not at a given time point can be shown by means of special devices measuring changes in $\partial A_\Sigma/\partial t$.

The detected regularities are used as the basis for a method of short-term forecasting of earthquakes with the probability close to 100% [10]. The invention [20] was awarded three gold medals in International Exhibitions in Brussels, Geneva, and Seoul.

Table 1. *Greatest earthquakes in the world in the second part of the XX century and in XXI century.*

№	Place, coordinates	Date, UTC time (Greenwich time)	Magnitude by Richter scale	γ	β
1	Kamchatka 52.76N 160.06E	1952 November 04 16:58:26.0	9.0	1°	-
2	Andreanof Islands, Alaska 51.56N 175.39W	1957 March 09	8.6	90°	-
3	Chile 38.24S 73.05W	1960 May 22 19:11:14	9.5	12°	-
4	Prince William Sound, Alaska 61.02N 147.65E	1964 March 28 03:36:14	9.2	14°	-
5	Armenia 41.0 N 44.2 E	1988, December 7, 07:41	6,9	-	41°
6	West Coast of Northern Sumatra 3.295 N 95.982 E	2004,December 26 00:58	9.0	90°	-
7	Sakhalin Island 52.63 N 142.83 E	1995, May 27 13:03	6,7	-	40°
8	Pakistan 34.53 N 73.58E	2005 October 08 19:46	7.6	90°	-
9	Haiti 19.0 N 72.0 W	2010 January 13	7.6	81°	3°

γ- Angle between projection of the vector Zenith and projection of the vector A_g on the plane of the ecliptic.
β - Angle between projection of the vector V and projection of the vector A_g on the plane of the ecliptic.

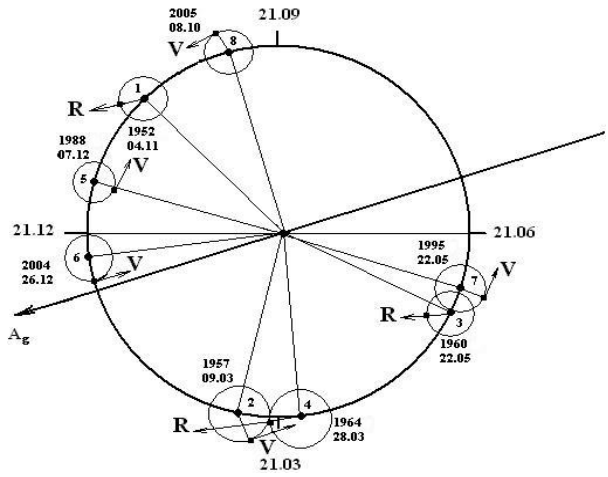

Fig. 3. *Directions of vectors: A_g, V and R (radius vector from Earth center or vector Zenith) for greatest earthquakes in the world in the second part of the XX century and in XXI century (see also Table 1).*

4. Tornadoes and the Global Anisotropy of the Physical Space

Whatever the processes leading to the onset of a tornado, afterwards it can further accumulate energy along its path by means of well understood processes [21-23]; two further concurrent processes are proposed, as in [11], which are assumed to sustain or reinforce a tornado during its development.

The first process stems from the consideration, already expressed in [11], that the reduction of the summary potential A_Σ by means of the Earth's gravitational potential, that is always negative, is stronger near the Earth's surface than at any height along the local vertical axis; therefore, according to the BT the flow in an updraft is further accelerated at the expense of the gravitational potential in the direction of the increasing summary potential, which coincides with the direction to the local zenith.

Such process appears similar to the one described in [3, 24] during the motion of a liquid substance powered by a centrifugal pump, in a closed circuit having ascending and descending sections (height of about 2.6 m), where additional energy is released at the level of 15-20%, which can't be explained from the perspective of standard calibrated physical models.

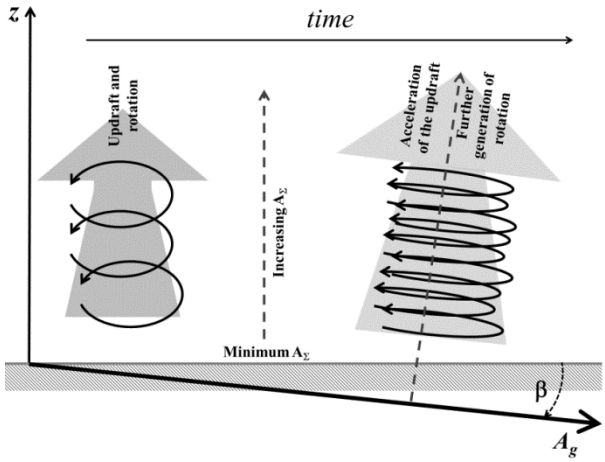

Fig. 4. *Very simplified scheme of the proposed processes contributing to the energy of a tornado system: A_g is the cosmological vector potential and β is its altitude with regards to the local Earth's surface (shaded in the picture).*

The second process is likely even more important and specific to tornadoes. In [1-3] is shown that according to the BT any natural rotation arises from the mechanism of minimization of the potential energy of interaction of byuons in their fundamental one-dimensional space. The latter applies as well to a tornado that can gain a fraction of energy of its rotational motion from the minimization of the potential energy of interacting byuons in regions with summary potential weakened by means of the Earth's gravitational potential; provided that the cosmological vector potential lies around the horizontal plane tangent to the local Earth's surface, this process results in the generation of further rotation around the vertical axis of any particle while rising in the violent updraft associated to the tornado, thus further contributing to the energy and lifetime of the tornado itself.

Fig. 4 shows a very simplified scheme of the proposed processes contributing to the energy of a tornado system.

As a result, the new proposed mechanisms could help to discriminate situations favorable for the further accumulation of energy into a tornado and therefore its development into an high intensity and/or long lifetime or path system.

In [3, 4, 25] experiments are discussed where, if the magnetic vector potential of a discharge current of intensity up to 4 kA is directed opposite to the vector $\mathbf{A_g}$ at an optimal angle (130°-135°), corresponding to the maximum action of the new force of nature, in the discharge can be released 20-40% more energy than that supplied by the power source; if the discharge currents are increased up to 200 kA, the situation can develop into an explosion, leading to the release of energy few orders of magnitude greater than the input energy.

On the basis of the above mentioned experiments as well as of the BT, at least a fraction of the energy available for the onset of a tornado can be explained as the result of the vector of the lightning current, provided such current is high enough, which is collinear to the respective magnetic vector potential, lying on the reverse cone of action of the new force or at least having a component directed opposite the vector $\mathbf{A_g}$ in order to weaken the summary potential $\mathbf{A_\Sigma}$, such additional energy coming from the process of formation of the masses of the particles in the discharge (electrons, etc.).

Considering a single cubic centimeter of the substance within the lightning discharge with current 100 kA, the value of N will be equal to about $2 \cdot 10^{20}$; the magnetic potential at the distance of 10^{-2} m to 1 m from the lightning strike is easily derived from its definition and the relationship between an electric current system and the associated magnetic field, assuming a linear straight current with length around 2 km, as $\Delta A_\Sigma \approx 10^{-2}$ T m.

For each of the elementary particles (protons, neutrons), the factor $\Delta(\Delta A_\Sigma)/\Delta x$ can be assumed equal to the value of the magnetic field in the vicinity of the proton (10^{12} T), as shown in [3,5], therefore at the optimal arrangement of the vector potential of the discharge current with respect to the vector $\mathbf{A_g}$ (angle between the vectors ≈ 130°), it follows from Eq. (3) that a cubic centimeter of discharge will receive a new force having an intensity on the order of 10 N.

Considering that the mass of 1 cm^3 of air is about 10^{-6} kg, the obtained force will result in a huge acceleration on the order of 10^7 m s^{-2}.

It's known [26] that a lightning strike can travel at speeds around 150,000 km/s, therefore, assuming that its path length is between 2 km and 10 km, its duration can be estimated in the range 10^{-5} s to 10^{-4} s; furthermore, the average width of a lightning bolt is between 2.5 cm and 5 cm, such width of course increasing with the lightning peak current. It could be noted as well that 10 cm is the order of magnitude of the distance a particle accelerated by the new force travels during 10^{-4} s.

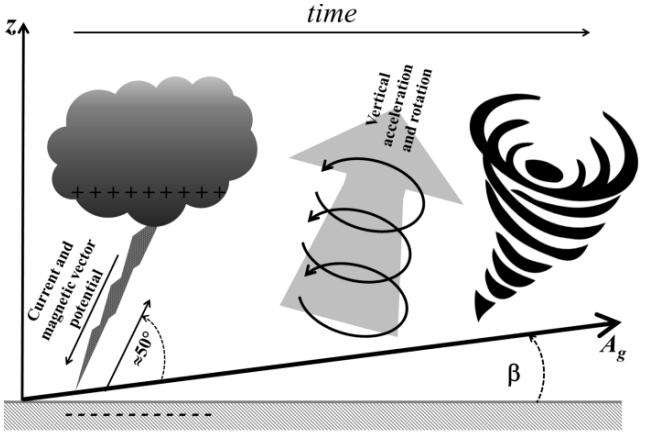

Fig. 5. *The simplified scheme of the proposed processes contributing to the onset of a tornado: A_g is the cosmological vector potential and β is its altitude with regards to the local Earth's surface (shaded in the picture); pluses and minuses indicate the cloud and surface electrostatic charges; the +CG lightning below the cloud base is represented too.*

On the basis of the above written, it appears reasonable to assume that the approximately empty cavity (i.e., with vacuum inside) created as a result of an intense lightning *explosion* has a characteristic size on the order of 10 cm, therefore activating the *quantum information channel* mentioned in [11] and proposed in [1-3], and allowing the previously accelerated particles at the boundaries of the cavity to gain substantial energy in the form of rotational motion, in turn contributing to trigger the tornado.

Fig. 5 shows a very simplified scheme of the proposed processes contributing to the onset of a tornado.

The verification of the above described additional mechanism contributing to the onset of tornadoes starting from intense lightning flashes on the basis of observational evidence with real tornadoes is very difficult for some reasons.

A source of difficulty arises from the fact that the proposed mechanism is not deemed at all *strictly necessary* for the onset of tornadoes but only a contributing process that sometimes can trigger tornadoes in otherwise less favorable atmospheric environments. Therefore, the fact that the onset of a tornado either allows or not for a role of the proposed mechanism doesn't speak about its reality.

Another source of difficulty lies in the fact that the tornadoes arise first at some elevation over the local terrain, i.e. inside the convective clouds, therefore the proposed mechanism can work both with cloud to ground (CG) and intra-cloud (IC) lightning flashes, the latter being hardly detected and characterized with regards to intensity, polarity, path by ground based lightning sensors. Additionally, the path is usually not available even for CG lightning.

Moreover, ground based lightning detection networks are mostly privately managed and the respective detailed data are confidential, including exact location, polarity and intensity, not to speak about the detailed path (if observed).

It is known [27] that positive lightning flashes (+CG), which are likely candidates for the activation of the proposed mechanism because they carry the highest peak currents, can follow very complex paths including long horizontal sections between convective and stratiform areas of the storm cloud system before delivering the positive charge to the ground. As a result, the only altitude of $\mathbf{A_g}$ can't be sufficient to assess its angular deviation with regards to the lightning discharge and the associated magnetic vector potential in the three dimensional domain, its azimuth being needed too.

At least an extensive analysis of the local atmospheric environment supportive of tornadoes would be needed for any event, as well as the observation of the intensity, polarity and possibly the paths of both CG and IC lightning would be required, at least for the most intense strikes, which could be available by means of new and future satellite sensors [28].

The analysis of about 500 tornadoes of classes F0 to F5 was carried out in [11].

The results of this study are following.

Despite the fact that the altitude of the cosmological vector potential $\mathbf{A_g}$ performs a daily cycle, modulated by the different geographical coordinates of the single tornado events, covering practically any value in the range about -30° to 90°, all events with tornado intensity in the classes F4 and F5 with path length greater than 30 km occur when the altitude of $\mathbf{A_g}$ is in the range -20° to 10° with regards to the local horizontal plane (see also Fig. 4).

5. Motion of Pulsars, Anisotropy of Cosmic Rays and Global Anisotropy of Physical Space

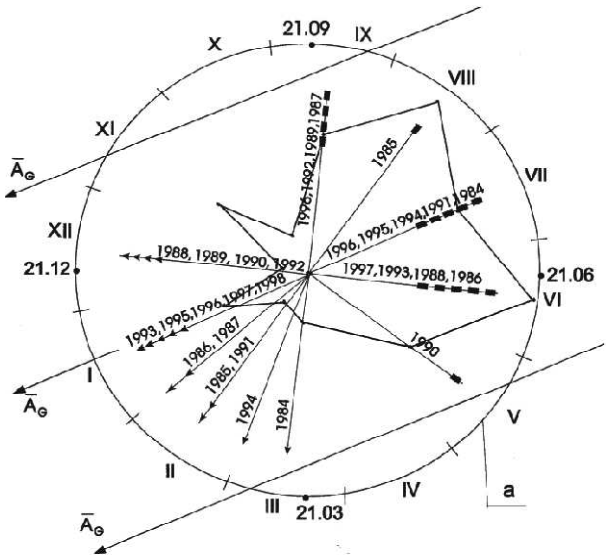

Fig. 6. *The angular histogram of season distribution (fourth and further months of year) of maxima and minima of decay rates on the Earth orbit (a) in the process of its motion around the Sun for a 15 years experiment with ^{226}Ra([29]). Maxima are indicated by arrows, minima by black rectangles. The Sun is in the center of the diagram. On the line from the orbit portion with decay maxima or minima to the place of the Sun, the corresponding years are indicated.*

Let us elucidate the action of the new force on pulsars. Pulsars are neutron stars formed as the result of collapse and explosion of a Supernova with the duration of an order of 10^{-3} sec. As shown in the works [12-15], the observable velocities of pulsars and their angular distribution can be explained by the action of the new force that must clearly reveal itself in the process since the magnetic fields of pulsars may be as great as10^{12}G, and hence the magnitudes of the vector potential may come close to the modulus of A_g. The reactive effect causes a pulsar to move oppositely to the direction of the new force. As is seen from Fig. 6, the main masses of pulsars move along the reverse cone of new force action which is in correspondence with the prediction of the BT and the angular opening of the season arrangement of ^{226}Ra α decay [29] rate also given in Fig. 6. The pulsars are very good instruments for investigation of the direction of vector A_g. Yet the pulsars give the information only at the scale of our Galaxy (10^{22} cm).

The solid line shows the angular distribution of the velocity directions of pulsars motion.

I, II etc. – months of year;

1988, 1989 etc. – years of maxima and minima of decay rates;

$\mathbf{A_g}$ – the cosmological vector potential;

21.03- etc. are characteristic points of the Earth orbit.

Anisotropy of cosmic rays (CR) can give the information about the direction of the vector $\mathbf{A_g}$ [30] at the size scale of our Universe, i.e. 10^{28} cm, if CR will have ultrahigh energy. In [30] the influence of a new anisotropic factor onto the mechanism of acceleration of cosmic rays up to ultrahigh energies (CR UHE) due to a new global natural force with the anisotropic behavior is considered. Let's discuss this work.

During the motion in the Universe the proton can cover, in the vicinity of galaxies, space distances where $\Delta A_\Sigma \approx 10^{11}$G cm. This value is the limiting one for our Universe and can be caused by the action on ΔA_Σ both by vector potentials of magnetic fields and by gravitational potentials [13].

It is commonly supposed that the protons in the Galaxy diffuse to the Earth for ten thousand years so that the whole distance $L \approx 10^{22}$cm (the measure of a medium-sized galaxy is ~10^{24} cm). If the force considered acts on scales of L, the energy imparted to the proton by the new force will be of order 10^{27}eV (much more than the Greisen-Zatsepin-Kusmin energy limit equaled to $5 \cdot 10^{19}$eV). It should be noted that to estimate the energy of cosmic rays we have used the linear approximation of new force (3) that gives, as the ground experiments show [1-3,6 - 9], nearly an order of magnitude greater value for the new force of nature. In addition, the interaction with the relic radiation will naturally diminish the value of energy obtained but the anisotropic properties of the assumed new force are bound to affect the anisotropy of CR UHE. The coordinates of their arrival to the Earth will be in correspondence with the opposite directions to the new force cone of acting. The work [30] demonstrates that the directions of action of the new force and anisotropy of CR of middle energy are near each other. The Cygnus Region (α = 305°±5°, δ = 40°±5°) shown in [30] practically corresponds to the direction of the cosmological vector potential A_g. It is no coincidence. The cause can be that the CR accelerated by the new force can, when interacting with substance, give rise to γ-quanta that move precisely in the opposite direction to the global anisotropy associated with the existence of vector A_g. But these CR can be and CR UHE. Therefore they can give information about the direction of the vector A_g in the scale of our Universe, which can be assessed as follows:
α = 305°±5°, δ = 40°±5°.

6. Dark Matter and Dark Energy in the Byuon Theory

DM is not observed as a shining matter and must be characterized by extremely weak electromagnetic interactions (according to the standard models [31-33]). It must be approximately collisionless and non-relativistic. DM is not primarily baryonic. The calculated amount of deuterium should be much smaller than the observed one if the average baryon density were an order of magnitude higher than the modern value (~0.3 baryons per cubic meter). The mass interval for the possible candidates in DM is huge (from 10^{-22} eV to 10^6 $M_\odot \approx 10^{72}$ eV).

In [16] were shown and discussed the most likely candidates in DM. In this article we shall discuss a problem of DM and DE in the frame of BT only.

Basic Hypothesis of BT.

Assume the observable three-dimensional space R_3 to appear as a result of minimization of the potential energy (PE) of VSs byuon interactions in the one-dimensional space R_1 formed by them. We construct PE after accounting for dimensions. More precisely, the space R_3 is fixed by us as the result of this byuon dynamics. In the space R_3 the dynamical processes for objects with the residual positive potential energy of byuon interactions originate, and in consequence, the wave properties of elementary particles arise.

Let's estimate the average density of substance in the Universe using the BT and taking its characteristic dimension equaled $\tilde{x}_0 NkP \approx 10^{28} cm$ (where: k, N, P are the calculated byuon interactions periods in index i = NkP; i is a quantum number for byuon; quantum of space $\tilde{x}_0$ are introduced in BT in the one-dimensional discrete space R_1 formed by byuons $\tilde{x}_0 \approx 2.8 \times 10^{-33}$cm).

It coincides with the assumed radius of the Universe. The total energy in the Universe can be represented as $\frac{h}{\tau_0} NkP$ (here τ_0 is the quantum of time ($\tau_0 \approx 0.9 \times 10$–43 s), h is the Plank constant). Its value is 5.4×10^{77}erg, and the corresponding equivalent mass $\approx 6 \times 10^{56}$g. The uniformity of distribution of substance over the sphere with the radius $\tilde{x}_0 NkP$ gives the density of substance in the Universe $\approx 10^{-29}$g cm^{-3}, which is measured in the known observations.

The physical space is a quantum medium of objects 4b (four-contact interaction of byuons, $m_{4b}c^2$ = 33 eV). The BT shows a nature of quantum mechanics [1-3, 34] writing the uncertainty relation in R_3 for elementary object 4b. Its momentum corresponding to the minimum momentum for elementary particles

$$P = \Phi \cdot E^0_{k_{min}} / c$$

where Φ is probability of observing the object 4b formed in the process of the four-contact interaction in some region of space R_3 (the minimum energy of four-contact byuon interaction $m_{4b}c^2 = E^{(0)}_{k_{min}} \approx 33$eV)

If the objects 4b are free (that is, they create not an elementary particle but physical space free of them), then $\Phi = \frac{1}{16} \cdot \frac{\tilde{x}_0^3}{4\pi x_0^2 \tilde{x}_0}$, where $\tilde{x}_0 \approx 10^{-33}$cm, and $x_0 \approx 10^{-17}$cm. In this case, if the scatter in values of the momentum is P for an elementary object Δp, then the uncertainty in the coordinate in R_3 for the object 4b will be equal to 10^{28}cm. This value ΔX gave us the possibility to obtain the density of matter in the Universe, observed in experiment, obtained after averaging it over the sphere 10^{28}cm in radius. From the modern point of view the 4b-objects with $m_{4b}c^2$ = 33 eV and ΔX= 10^{28}cm, form the so-called cold dark matter – the quantum medium corresponding to the observed physical R_3 space.

If the object 4b is not free (that is, it forms the internal geometry of an electron, for instance), then

$$\Phi = \frac{1}{16} \cdot \frac{x_0^3}{4\pi (Nx_0)^2 x_0} \quad (4)$$

and we can write the following expression for an assemblage of objects 4b forming an electron (for which $m_e c^2 = N \cdot E_{kmin}$):

$$\Delta p = \frac{1}{16} \cdot \frac{x_0^3}{4\pi (Nx_0)^2 x_0} \cdot \frac{NE^0_{k_{min}}}{c} = \frac{1}{64\pi} \cdot \frac{E^0_{k_{min}}}{Nc} \quad (5)$$

Using Eq. (5) we obtain the uncertainty in coordinate Δx in R_3 of the order to 10 cm for the assemblage of N objects 4b, that is, the electron, due to wave properties of N objects 4b, carries information on its properties not over distances of 10^{-8}cm (characteristic dimension of the de Broglie wave for electron at the temperature of 300K) as would be in the case of a point wise particle, but over distances of the order of 10 cm.

When considering not N objects but one object 4b in the electron (that is, when Formula (4) is valid) then $\Delta x \approx 10^5$ cm. Hence the less is an information on conditions of internal spatial characteristics of electron, the more is the scatter in coordinate.

In the modern terminology 4b-objects forming elementary particles (their charges, masses and so on) and having ΔX from 10 to 10^5 cm create the hot or warm dark matter.

In [1,2] a qualitative pattern of a common approach to unifying all interactions is shown.

Let's describe the connection of the new force with DE.

To estimate the role of the gravitational field in a change of $|\vec{A}_\Sigma|$ we introduce the maximal gravitational potential φ_{max}, determined for the proton by the following relationship:

$$m_p \varphi_{max} = e|A_g| \quad (6)$$

where m_p is the proton mass. Then the contribution of φ_{max} in the change of $|\vec{A}_\Sigma|$ is described by the following equality:

$$\varphi_{max} \cos m_p = eAv/c, \quad (7)$$

where v is in this case the velocity of our Galaxy relative to the neighboring galaxies, while cos = $\cos^{NkP-i-2,\,NkP-i}_{II^-II^-}$ (see [1-3]); it characterizes non-orthogonality of our World at the moment of the formation of the space of elementary particles. It is worth noting that potentials of physical fields have the physical meaning only for interacting byuons when elementary particles are generated with their masses and charge numbers.

It is known that the gravitational potential φ is negative, and therefore for any summation of potentials it decreases the modulus of A_Σ. The fraction of mass of elementary particles is proportional to this modulus. Hence the new force will push out any material body from the region of the decreased modulus of A_Σ, because a defect of energy $\Delta E = \Delta mc^2$ will appear and the corresponding force will act to the region with undisturbed value of A_Σ. Any material body decreases in its own region the modulus A_Σ due to potentials of physical fields of all its elementary components, i.e. creates the gradient $\Delta A_\Sigma/\Delta x$. Gravitationally acting mass, for example, our Galaxy, creates around itself the gravitational potential φ. To estimate the action of one galaxy to another we put in the formula (3) the potential φ_{max} from (6) and ΔA_Σ from (7) (ΔA_Σ = A). Let us estimate the distance R_{GG} where the new force F from (3) will be higher than the gravitational force F_g.

$$R_{GG} \geq GM_g^2/(2Nm_v c^2 \lambda_1^2 \cos^2 \varphi_{max}^2 (m_p c/ve)^2) \quad (8)$$

where G is the gravitational constant.

Here M_g is the mass of the one of interacting galaxies. We consider an interaction of two galaxies like Milky Way with 10^{11} stars, assume that the mass of each star is of the order of the solar mass (~ 10^{33} g) and a relative velocity of each galaxy v = 100 km/sec and 1000 km/sec. From our experiments $\lambda_1 = 10^{-12}$ [1-3, 12]. As the result we obtain from (8) 10^{27}cm<R_{GG}<10^{28}cm for v = 100 km/sec and $R_{GG} > 10^{28}$ cm for v = 1000 km/sec.

Thus we have estimated the magnitude of the distance between galaxies above which they scatter under the action of the new force. The obtained estimate seems reasonable and indicates that the physics of byuons is perspective to explicate the nature of dark energy and dark matter.

7. Conclusions

1. As distinct from all earlier models of earthquakes [16-33], the theory of byuon allows to establish the deep-seated nature of physics of earthquakes, and therefore to predict place and time of an earthquake with the probability close to 100%.
2. A brief comparative analysis of investigations results of the coordinates and the beginning times of earthquakes and arising of tornadoes, motion of pulsars and anisotropy of cosmic rays show directions very close to vector $\mathbf{A_g}$ which we got in the experiments with plasma devices [1-9]. Nevertheless, the results of our experiments on Earth near Sun can undergo the action of potentials from different fields of Earth and Sun, therefore the direction of vector $\mathbf{A_g}$ must be near the direction to the Cygnus Region (i.e. $\alpha = 300° \pm 10°$, $\delta = 36° \pm 10°$).
3. The new force using the gravitational potential can lead to the observable expansion of our Universe at distances ~ 10^{26} – 10^{28} cm where it becomes higher than the gravitational force. Therefore this estimate shows that the new interaction can be used for the explanation of Dark Energy.
4. Physical space in our Universe is the quantum medium of special objects 4b (BT), formed in four-contact interactions of byuons ($m_{4b}c^2 \approx 33$eV). These objects determine the average density of substance (Dark Matter) in the Universe ~10^{-29}g cm^{-3}.

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