On the Physical Model of the Phenomena Registered in the Experiments by Shnoll's Group and Smirnov's Group

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The study of experimental data leads to the conclusion about the existence of the fields of the Earth as not being of clear physical nature. The structure and properties of these fields on the Earth's surface are studied. These fields turn out to be related to the motions of matter and, in particular, to the internal motions of the Earth itself. Therefore, the fields may include precursors to earthquakes that conform to experiments. The disclosed statistical relations of seismicity with the planet configurations, sunrises and sunsets, and with the pulsar impact becomes logical. Other planets, the Sun and the Moon must possess the same fields.

1 Introduction

Nearly thirty years ago, Meidav and Sadeh [1] discovered the effect of pulsar CP1133 on seismicity that triggered the professionals' interest. Ya. B. Zeldovich immediately apprehended the potential meaning of this phenomenon. According to him, even if that message would be by ten per cent true, he would only engage himself with this issue. According to Weber, the energy of the pulsar gravitational waves is many orders of magnitude lower than that required for the detected pulsar effect on seismicity. The interest in this phenomenon gradually shrank to a nullity, mainly because this phenomenon had not acquired any reasonable interpretation. At about the same time, Ben-Menachem, the famous seismologist, detected a correlation between seismicity and sunrises-sunsets that could not be explained as well. As a consequence, the above Ben-Menachem's discovery was overridden, although he insisted that his experimental results were correct. Recently, Georgian seismologists have found a correlation between the planets' configuration and earthquakes [2]. Moreover, as it turned out, some distant planets rather than neighboring planets play a part in this correlation. T. Chernoglazova has disclosed a strong correlation between earthquakes and the coverings of the planets and the Sun by the Moon (in the sky). A. Ya. Lezdinsh has advanced further. He forecasts the epicenter, the time and the magnitude of the earthquakes at the same time for Kamchatka Peninsula by using the correlation between earthquakes and stellar bodies' positions relative to the Earth and the local horizon plane [3]. This method comes first in the open competition among many methods of earthquake forecast (with maximal magnitude error 0.4 point). At rises and settings, the upper and the lower culminations of the Sun, the Moon and the planets, Smirnov's detector (a specific gyroscope on a magnetic suspension) changes its average angular spin rate by 0.7–1.5% for a short period of time (generally, 1.5–3 minutes) [4–8]*. For instance, at the rises of Jupiter the gravitational effect on the detector is one and half billion times weaker than that of an observer moving around the detector†. However, the device responded to the planet but no to the observer. As in Refs. [1, 2, 3], here we again observe an effect of the planets on the motions in the Earth's region with a lack of the effective energy for such an event, and against all else, much more powerful effects. Smirnov's detector produces as well the anomalous signals, the strong earthquakes precursors for 2–10 days before strong earthquakes [9]. They are quite distinct from other signals due to their unusually high amplitude and extended duration (refer to Figs. 4 and 5 in Ref. [9]). Since Smirnov's detector indicates direction to the signal source as well, the perspective appears to find epicenters of the future strong earthquakes up to thousand kilometers off the detector that demands the labor-consuming but necessary forecast finalizing technique. Smirnov's and Shnoll's detectors respond to the same astronomical phenomena, but Shnoll's one shows variations not in angular velocity but in the G histogram shapes representing macroscopic fluctuations of the rates of physical processes‡. In their experiments, Shnoll's group [10–15] has studied G histograms for processes of different physical nature and different energy saturation, from radioactive decays and chemical reactions to the noises in gravitational antennas. Despite of the great differences in energy saturation of the above processes (forty orders of magnitude) their G histograms taken at the same time tend to look alike§. The effects of the Sun and the Moon on the G histograms have been disclosed. To put it differently, again a certain distant impact on the processes is disclosed in the absence of any accordance between the impact energy and the energies of the processes. According

*Developed by Kurchatov Institute of Atomic Energy and MEPHI.

†For proper calculation of the gravitational effect of planets, account must be taken of free falling of the Earth in an external gravity field.

‡Developed by Institute of Theoretical and Experimental Biophysics, Russian Academy of Science.

§More precisely, a probability increase of similar histograms occurrence is observed. For brevity's sake, this will be referred to as occurrence of similar histograms.

to S. E. Shnoll, the G histograms' shape variations are generated by space-time fluctuations, because, as pointed out, it is the only common factor for such different processes [14]. S. E. Shnoll has drawn attention to the important fact of the energy-free nature of the considered impacts [15]:

> "... The energy variation range for the processes under study equals tens of orders of magnitude. It is therefore clear that the "external force" that causes synchronous alteration of the histogram shapes is of the non-energy nature."

Recently, responding to my request, V. A. Zubov et al. (2008, Germany) have accordingly adjusted the technique of their experiments. As a consequence, their direct physical experiment has confirmed, at last, a significant impact of planets on the living matter on the Earth [20]. For instance, during the upper culmination of the Jupiter, the abrupt pulse variations in the mean molecular weight of potato biomatrix clusters, in terms of the number of the various clusters and their energy irradiation, were observed [20]:

> "During the Jupiter upper culmination the reliable picture of its effect on the potato biomatrix is disclosed. ... the Jupiter effect is unexpectedly strong during its culmination ... the commensurability of the planet and the Moon effects follows from the experimental data".

At least an approximate explanation of the above referred phenomena is in order. A physical model is created below as a logical consequence of the accumulated experimental material. The model allows us to approach the understanding of many of the described, seemingly paradoxical, facts. As long as the detectors are located on the Earth, as the unique planet, the effects of that can be studied in any direction relative to its center, whereas the effects of the other planets, the Sun and the Moon may be investigated on the Earth's orbit only. Shnoll's detector has been used in observations in various geographical regions, including the North Pole and Antarctica regions. Therefore our searching is based on the investigations of Shnoll's detector data and the corresponding impacts, mainly, of the Earth. This paper is based on the Refs. [16, 17].

2 Shnoll's detector data and the principles of their physical modeling

Initially the duration Dt of the histograms G was 1 hour. Presently, it has been reduced to less than a second. Let us denote the histogram with duration Dt confined to the time moment t as $G(t)$*. Let us denote the corresponding histograms from detectors A and B as $G_A(t)$ and $G_B(t)$, respectively. Using the detectors' data, observers can plot the graph of the probability of occurrence of the similar histogram shapes $G_B(t + \delta t^*)$ and $G_A(t)$ depending on the time shift δt^* and then seek a narrow peak (or peaks) of the probability increase and determine such time shift δt, at which a maximum peak occurs. (The peak width is usually equal to a few of the histograms durations Dt.) In what follows, the regularities of appearance of the similar histograms $G_B(t + \delta t)$ and $G_A(t)$ at the above maxima are studied depending on the time shift δt and on the detectors' locations. Let us conditionally denote the similarity of histograms as $G_B(t + \delta t) \approx G_A(t)$, and the coincidence of the histogram shapes as $G_B(t + \delta t) = G_A(t)$. The above equalities refer to the similarity of two histograms taken at the maxima of the aforesaid peaks, in the presence of these peaks, but not with respect to a random similarity of any pair of histograms. For brevity's sake only, the histograms $G_B(t + \delta t)$ and $G_A(t)$ similar at the above maxima denoted below shall simply be referred to as "similar histograms". A series of the cycles and the regularities in the occurrence of similar histograms has been determined. To understand the physical meaning of these cycles and regularities, the physical principles of their modeling should be established (listed below as enumerated notes).

Note 1: As mentioned above, the histogram shape varies with distance effects, at least, of the Sun and the Moon. In physics, the substance that transmits a distance effect is called a "field". Thus let us consider that the histogram shape is changed by some field† F (probably, of electromagnetic or gravitational origin). The field F may be multi-component (i.e. is composed of the sub-fields F_1, F_2, F_3, etc.) and many various sources of the field F may exist. To interpret Shnoll's detectors data, the following postulated rules will be used. The character of the field F impact on the detector is mapped into the histogram shape. The identical histogram shapes (at the maxima of the mentioned peaks) correspond to the identical impact character of the field F_i (where $i = 1, 2, 3, \ldots$) from a single source, the histogram shapes at the mentioned maxima are not identical but only similar due to the different effects of the fields from others sources and/or other field components from the same source. Disclosed repetitions of similar histograms correspond to repetitions of the impact character of some field component F_i or of some field F. If one of the Moon, the Sun, and the Earth possesses a field F_i, then all of them possess this field‡. ■

According to Note 1, if the impact of the mentioned component on the detector is much stronger than other impacts, almost an identical histogram shape with almost a hundred percent probability should be observed. The Earth is surrounded by different celestial bodies. Of them, the highest variable impact on the Earth is caused by the Sun and the Moon. Their maximal impact should be expected when they are in the ray aimed at the Earth. Actually, during solar eclipses, several Shnoll's detectors located in different geo-

*For example, the time moment t may be the middle or the beginning of the $G(t)$ histogram.

†In the articles by Shnoll's team, a cloudy notion of some "structures" affecting the histograms is used. This one is used instead of the field notion. This one is not explained [15].

‡The fact that this statement is true becomes clear from the sub-section "About the reasons of the field beginning...".

graphical locations, produce at the same moment almost identical histograms with nearly a hundred percent probability [14]. This confirms the principles postulated in Note 1 and indicates also that the statistical properties of the macroscopic fluctuations, displayed by the histograms, are not random at all, but that they are distantly generated by celestial bodies, i.e. by their some field F. Thus an intensification of the impact of the field F (relative to the background) is displayed by the histograms through probability increase in the maxima of the above peaks. Therefore, through the histograms, one can judge about the character and relative strength of the impact of the field F and can also grade it using the probabilities at the maxima of the peaks. Then the field conception will start to possess the quantitative character. As far as the author knows, such dynamic investigations have not been performed yet. It is useful to perform them through a quantitative study of time and space distribution of the relative impact force, induced by each field component F_i from each source. For this purpose, localized observations at very short distances between the Shnoll detectors are most suitable [11]. According to experimental results, during the solar eclipse the above-mentioned peak's width is much shorter than the eclipse duration. Consequently, interaction between the field F from the Sun and the Moon at their junction is of a strongly marked, very short, splash-like character. Similar events happen during full-moon and new moon times [14].

Note 2: If an impact character on the detector is constant in time, then (in the absence of other impacts), according to Note 1, it induces histograms $G(t)$, whose shape is independent of time: $G_B(t+\delta t^*) = G(t)$ at any δt^*. As a consequence, there is no peak of histogram similarity at some definite time shift δt^*. Therefore, when the character of impact gradually becomes constant, the histogram similarity peak smears out gradually and disappears. Therefore, *the Shnoll technique based on the separation of the histogram similarity peaks is unable to identify impacts of constant character*. In this case, the Shnoll technique *gives the impression of an impact's absence, although the detector itself records both changing and constant impacts*. In the case of constant impact, another technique is required to investigate the near-zero temporal frequencies against the parameter δt^*. When a constant impact is considered in the background of a multiplicity of other changing impacts on the detector, conclusions remain the same, but the histogram shapes become rather similar than coincidental (this, of course, if a constant impact still remains visible in the presence of the other impacts). ■

Let $\{\mathrm{V}_d^m\}$ be the detector's movement parameters, where $m = 0, 1, 2, 3, \ldots$ and V_d^m is the m-th time derivative of the detector's speed V_d, $\mathrm{V}_d^0 \equiv \mathrm{V}_d$. The same set $\{\mathrm{V}_S^m\}$ denotes the movement's parameters of any object S.

Note 3: It is not excluded that the character of the impact on the detector is defined by both the field F and orientation O of some detector motion parameters $\mathrm{V}_{d,a}^m$ (belonging to a set $\{\mathrm{V}_d^m\}$), to be called active, relative to a ray L by which the field F arrives (similar to the case of a magnetic field and a moving electrical charge). The *force and character of the impact* may depend, of course, on the values of the motion parameters. Apparently, the active parameters $\mathrm{V}_{d,a}^m$ represent acceleration and/or acceleration derivative, and/or rate, etc. Let the field F, whose impact character depends also on the orientation O, be called the *second-type field* F_2 and be distinguished from the *first-type field* F_1, whose impact character is independent of the direction of the detector's motion parameter. If there is a dependence of the impacts on the motion parameters, let us consider the following: the Earth's field impact depends on the parameters of the detector's motion relative to the Earth, while the Sun's field impact depends on the parameters of the detector's motion relative to the Sun, etc. To put it differently, the impact of a field from some source depends on the detector's motion parameters relative to this source. The following question arises: whether or not the first and the second-type fields exist? ■

Generally, the experimental data will be studied in reference to a geocentric (GSC) and heliocentric (HSC) systems of coordinates. The GSC does not rotate relative to "motionless" stars. In the GSC, the Earth spins. In the GSC, let us determine the latitude φ and longitude θ of the Earth's surface points relative to the geographical Earth poles in the usual manner, but the meridian $\theta = \text{const}$ and the parallel $\varphi = \text{const}$ do not rotate relative to "motionless" stars. Let two detectors A and B be fixed on the Earth's surface and at time t in GSC have longitudes $\theta_A(t)$ and $\theta_B(t)$ and latitudes $\varphi_A(t)$ and $\varphi_B(t)$, respectively. For definiteness, if the detectors are located at different rotating geographical meridians, let us consider that the detector A is positioned ahead of detector B relative to the Earth's rotation direction. In the GSC system, detectors rotate about the Earth axis, moving along a motionless parallel given by $\varphi = \text{const}$.

According to the experiment [10, 11, 14], as the detector slides along the a motionless parallel $\varphi = \text{const}$, its histograms change, but the following equalities, which express the *effect of local sidereal time*, according to the terminology of experimentalists, stand:

$$G_B(t + \delta t_{ST}) \approx G_A(t) \ \text{ at } \ \varphi_A(t) = \varphi_B(t) = \text{const}, \quad (1)$$

$$G_B(t) \approx G_A(t) \ \text{ at } \ \theta_A(t) = \theta_B(t)\,, \quad (2)$$

$$G_A(t + T_{ST}) \approx G_A(t)\,, \quad (3)$$

where T_{ST} is the sidereal day, $\delta t_{ST} = t_{ST,A} - t_{ST,B}$, $t_{ST,A}$ and $t_{ST,B}$ are the local *sidereal* times at the locations of the detectors A and B, respectively. Sidereal day, T_{ST}, is the period of rotation of the Earth and the detectors in the GSC system about the Earth axis. In particular, in the GSC, at the moment $(t+T_{ST})$, the detector A returns to the same location, where it was at time t. In the GSC, when the detector is fixed at a geographical point on the Earth's surface, its parameters V_d^m are the same with the respective parameters $\mathrm{V}_d^{SPIN,m}$ of the detector's fixation point's rotary (spin) motion about the Earth axis:

$$\mathrm{V}_d^m = \mathrm{V}_d^{SPIN,m}. \tag{4}$$

Obviously, the directions (and the values) of the parameters V_d^m of the detectors' rotary motion relative to the "motionless" stars are also repeated with the same period T_{ST} in the GSC system. The velocity V_d and its even order derivatives are directed along the tangent to the local parallel at the detector's location point. The odd-order derivatives of the rate V_d (including acceleration V_d^1) are directed along the local normal to the Earth's axis dropped from the detector's location point to the Earth axis. Therefore, in the GSC system, directions of the parameters V_d^m do not change along the meridians. In the GSC, the local sidereal times $t_{ST,A}$ and $t_{ST,B}$ unambiguously characterize the angle of detectors' rotation about the Earth axis relative to their initial position at the moment $t_{ST,A} = t_{ST,B} = 0$. In the GSC, the difference, δt_{ST}, represents a period of time, after which detector B arrives at the same place, where detector A was at the moment t. Therefore, by virtue of Note 1, the equalities (1)–(3) mean:

Statement 1: There are some fields F, whose summarized impact character at the Earth's surface points depends on the point location in the GSC, but not on time (equalities (1) and (3), and changes in the GSC along the motionless parallels and is constant along the motionless meridians of the Earth (formula 2). ■

For example, the effects (1)–(3) may be explained by the existence of the Earth's own field of the first type, not rotating in the GSC and changing along the motionless parallels but being constant along the motionless meridians of the Earth. The effects (1) and (3) may also be explained by the existence of an external field of the second type F_{2ext}, whose rays L_{2ext} are mutually parallel, and the field itself is constant at the Earth's orbit. According to Note 3, this shall lead to repetitions in the impact character of the field F_{2ext}, when the directions and magnitudes of the vectors V_d^m are repeated. By analogy, according to Note 3, the effect (2) can be caused by the Sun's field F_{2S}, of the second type, because the directions of the Sun rays and the parameters V_d^m along the Earth meridian do not virtually change, and, therefore, the angles between them do not change along this meridian as well. As can be seen, the use of only the local sidereal time effects gives multiple interpretations.

Just as the above, the effect of the *local solar time* has also been discovered experimentally [14] and is split into three equalities (detectors A and B are again fixed at the Earth's surface)

$$G_B(t + \delta t_S) \approx G_A(t) \text{ at } \varphi_A(t) = \varphi_B(t) = \text{const}, \tag{5}$$

$$G_B(t) \approx G_A(t) \text{ at } \theta_A(t) = \theta_B(t)\,, \tag{6}$$

$$G_A(t + T_S) \approx G_A(t)\,, \tag{7}$$

where T_S is the solar day; $\delta t_S = t_{S,A} - t_{S,B}$, $t_{S,A}$ and $t_{S,B}$ are the local *solar* times at the locations of the detectors A and B, respectively. The solar day, T_S, is the period of repetitions of the upper culmination of the Sun. By analogy, the effects of the local lunar time, the local planetary time, etc. may be introduced, but these effects have not been studied experimentally by Shnoll's group. Since the effects (5) and (7) include the local solar time, they obviously relate to the impacts of the Sun. Due to the Earth's motion along its orbit, the direction from the Earth to the Sun changes slightly, approximately by a degree per day. Therefore, the solar day is approximately 4 minutes longer than the sidereal day. The parameters V_d^m of the detector's motion relative to the Sun, i.e., in the HSC system, are composed of the detector's rotation relative to the Earth's axis (spin) and of its motion together with the Earth along its orbit. As a consequence, in the HSC system

$$\mathrm{V}_d^m = \mathrm{V}_d^{SPIN,m} + \mathrm{V}_d^{ORB,m}, \tag{8}$$

where $\mathrm{V}_d^{ORB,m}$ are the orbital motion parameters of the Earth and the detector. Despite the almost full coincidence of the formulae (1)–(3) and (5)–(7), their physical meaning is significantly different. Obviously, the orientation of the parameters $\mathrm{V}_d^{ORB,m}$ in relation to the Sun's ray, L_S, passing through the detector, does not change with time*. The orientation of parameters $\mathrm{V}_d^{SPIN,m}$ relative to the ray L_S, after a solar day T_S, is repeated with high accuracy. This repetition would have been exact, if the angle of the Earth axis to the ray L_S did not change during a solar day T_S, but as is known, it changes a little — by one fourth of a degree per day, approximately. Thereafter, the parameters of the spin motion of the detectors A and B at the times t and $t + \delta t_S$, respectively, have an almost equal orientation relative to the ray L_S. Therefore, by virtue of Note 3, the effects (5) and (7) can be explained by the existence of the Sun's field F_{2S} of the second type, almost or exactly cylindrically symmetrical relatively to the axis passing through the Earth's orbit center, and almost or exactly perpendicular to its plane. If, indeed, such the field F_{2S} does exist, its impact should be repeated almost or exactly everytime, when the orientation of the parameters $\mathrm{V}_d^{SPIN,m}$ relative to the ray L_S is repeated. This is really what happens according to the relations (5) and (7). The same effects could be explained in other ways. For example, by the repetitions of the total impact of the Sun's and Earth's fields, resulting from the repetitions of the angles between the solar ray L_S and the ray L_E of the Earth's own field radiated from the Earth's center or from its rotation axis. It is seen here again that the use of only the local solar time effects gives multiple interpretations.

Which field existence could be determined unambiguously? Let us answer this question using some other experiments. Experiments using collimators have the decisive meaning for answering the above question. As it turns out, the theoretical

*Within the accuracy of the Earth's orbit deviations from a circular orbit.

study of the experiments with collimators predicts many of the effects (1)–(3) and (5)–(7) as well as the results of other experiments. The study is based on the discovery and using of the significant differences of the physical meaning of experimental results obtained by using detectors of different types.

3 The particular rôle of the Shnoll radiation detectors

The effects of the local time (1)–(3), (5)–(7) are confirmed experimentally by the histograms records of processes of different physical nature. For example, there is a version of Shnoll's detector D_α based on the histograms recording of the quantity of the moving α-particles emitted by the compact radioactive source Plutonium-239 (^{239}Pu). Another version of the detector D_{noise} is based on the histograms recording of the noises in semiconductors. Seemingly, it's all the same, which physical process is used, because processes of different physical nature display similar histograms at the same time (see Introduction). Therefore, in the works of Shnoll's group, no difference is made between the physical meaning of the experimental results obtained by the detectors D_α and D_{noise}. However, in practice, the difference is considerable. Without the understanding of this, it is difficult to correctly understand the many valuable experimental results of Shnoll's group. This difference is essentially used below.

The motion parameters V_α^m of the α-particles emitted in different directions are differently oriented in space and, therefore, they are differently affected by the fields of the second type. If fields represented by F_2 exist, the histograms of the α-particles emitted in different directions should be different, i.e., at the level of macroscopic fluctuations an impression of the space anisotropy should be formed. The phenomenon described is, indeed, observed in the experiments with the collimators, which cut off pencils of the α-particles' emission directions [13, 14]. According to the results of all experiments with the collimators, S. E. Shnoll comes to a conclusion [14]:

> "…the shape of histograms depends on the α-particles' emission direction in relation to a particular point of the celestial sphere".

Theoretically, the impact character of the type-two field F_2 on any detector should be depended on the orientation O of the active detector motion parameters $\mathrm{V}_{d,a}^m$ relative to the ray L_2, by which the impact of the field F_2 comes to the detector. However, the points of the Earth equator are rotated by the Earth about its axis at the linear speed $V^{EQV} = 0.465$ km/s. The average speed of the Earth's orbital motion equals $V^{ORB} = 29.765$ km/s. The average kinetic energy of the α-particles emitted by Plutonium-239 equals 5.15 MeV, which corresponds to the α-particle emission speed of $V_\alpha = 15760$ km/s. Obviously, the speeds V^{EQV} and V^{ORB} are negligibly small in comparison with the speed V_α. The act of the α-particle irradiation is so short (tiny parts of a second) that for the acceleration and acceleration derivatives the ratios are very much not in favour of these motions of the Earth. Therefore, I conclude:

> Actually, the impact character of the type-two field F_2 on the detectors D_α is independent of the parameters $\mathrm{V}_d^{SPIN,m}$ and $\mathrm{V}_d^{ORB,m}$. This character depends only on the field F_2 and directions of the α-particles emission (used in the detector D_α) relative to the ray L_2.

In the collimator detector $D_{\alpha K}$, all parameters V_α^m of the α-particles motion are directed along the collimator. Hence, firstly, the detectors D_α are, in fact, inapplicable to the study of the effects on the histogram shapes of the directions and magnitudes of the vectors $\mathrm{V}_d^{SPIN,m}$ and $\mathrm{V}_d^{ORB,m}$. Secondly, the collimator detectors $D_{\alpha K}$ are almost the ideal tool for disclosing the second-type field and for the study of its impact character dependence on the angles between the motion parameters and ray L_2. General scheme of experiments for the disclosing of the field F_2 is simple: the collimator detector $D_{\alpha K}$ voluntarily, but periodically, with some period T, changes its direction relative to the ray L_2. Then, at each repetition of the orientation of the detector $D_{\alpha K}$ relative to the ray L_2, the repetitions of the impact character of the field F_2 and of the histogram similarity must be observed. Here it's all the same, either the collimator is fixed relative to the local horizon plane (LHP) and changes its direction periodically due to the Earth rotation or the detector direction is changed by an experimenter. To determine the direction, for instance, of the ray L_{2ext} of the field F_{2ext}, the collimator $D_{\alpha K}$ should periodically circumscribe a round cone with some cone axis O_K and some constant angle γ_K between the axis and generator of this cone. When the direction of the axis O_K approaches to an unknown direction of the ray L_{2ext}, the peak at the point $\delta t = T$ must gradually spread and disappear completely, when the directions of the axis O_K and ray L_{2ext} coincide. Indeed, when the axis O_K is parallel to the ray L_{2ext}, the angle between the ray L_{2ext} and the collimator is not changed if the latter circumscribes a round cone. Therefore, the impact character of the field F_{2ext} on the collimator's α-particles is permanently constant. Then according to Note 2, the narrow similarity peak disappears. The experiments with rotating collimators have been run in [13]. However, since the above specific rôle of the detectors $D_{\alpha K}$ has been unclear, it has also been impossible to understand what we are to do with the collimators and how we should understand the results of the experiments with the rotated collimators. Therefore, firstly, insufficient attention has been paid to the experiments with the rotated detectors $D_{\alpha K}$. As a result, such experiments has been run very little. Secondly, the results of these experiments have caused bewilderment among their authors [13]:

> "Despite the fact that the results obtained are quite clear, they cause natural bewilderment … Apparently, explanation of these phenomena requires changes in the general physical concept".

The bewilderment was caused by dependence of the histogram shape on the collimator's direction, disclosed in [13]. Thirdly, the authors of the experiments have come to the main conclusion of the article [13] that the said angular dependence "*point to the sharp anisotropy of the space*". Fourthly, by means of the experiments with the detectors D_α, the impact character and histogram shape dependencies on the directions of the impacted object's motion parameters has not been investigated.

The bewilderment is resolved, if we take into consideration the angular dependence of the type- two field impacts on the moving α-particles, whose existence may be discovered just in the experiments with the rotated collimators. Obviously, not every angular dependence is equivalent to the space anisotropy. Therefore, the problem about the space anisotropy requires further development. If S. E. Shnoll is correct in the statement that changes in the histogram shape are induced by the fluctuations of the space-time properties [14], it is most likely, that the matter is thus: the type-two fields generate the space-time fluctuations; but in the near-Earth region the space is isotropic, and the small space fluctuations are anisotropic (more precisely, they depend on the angles between directions in the space and the ray of any type-two field). By the concourse of the circumstances, the experiments with the rotated collimators [13] coincide with the particular version of the above general scheme of the experiments for the detection of the field F_2 with the following particular parameters: the collimator circumscribes a round cone; the axis O_K is parallel to the Earth axis; $\gamma_K = 90°$ (i.e. the collimator rotated in the local parallel plane $\varphi =$ const); $T = \frac{1}{4}T_{ST}, \frac{1}{3}T_{ST}, \frac{1}{2}T_{ST}, T_{ST}$. These experiments are suitable for the disclosure of the type-two fields of the Sun, the Earth and the sources external to the Solar System. The experiments for the determination of the direction of the ray of the external field F_2 have not been carried out.

Note 4 (on the technology of the experiments): In the plate-type detectors $D_{\alpha P}$, the point-like radioactive source is located so close to the plate P detecting the α-particles that nearly half of all α-particles are detected. In this case, the α-particles are detected at once upon the setting of directions of the emission. This is equivalent to the integral detection of the α-particles by the many differently directed collimator detectors $D_{\alpha K}$. The central direction of the α-particles' entrapment coincides with the line perpendicular to the plate. Let's draw the perpendicular line through the plate center. By symmetry, the directional diagram of the detector $D_{\alpha P}$ is symmetrical relative to this perpendicular line. Therefore, the direction of this perpendicular line characterizes the directivity of the detector $D_{\alpha P}$ and its orientation in space. This perpendicular line we shall name the axis of the detector $D_{\alpha P}$ and we shall denote it as $O_{\alpha P}$. In the experiments, the plate P was always fixed horizontally relative to LHP and, consequently, was turned about the Earth axis together with LHP and the parameters $\mathrm{V}_d^{SPIN,m}$. Hence:

> During the Earth rotation, the spatial orientations of the detector $D_{\alpha P}$, LHP and parameters $\mathrm{V}_d^{SPIN,m}$ are always changed synchronously and equally.

Primarily, the effects of the local time (1)–(3), (5)–(7) was disclosed by the plate-type detector $D_{\alpha P}$ and then confirmed by the noise detector D_{noise}. ■

4 The disclosure and the cylindrical symmetry properties of the type two field F_2

Let F_{2ext} be some second-type field, external in relation to the Solar System, whose ray L_{2ext} and the field F_{2ext} itself are constant within the spatial area covered by the Solar System during the entire period of the experiments. How can we disclose the field F_{2ext} and determine the direction of its ray? In accordance with the above-mentioned general scheme, we should change the direction of the collimator $D_{\alpha K}$ relative to "motionless" stars almost voluntarily but periodically, with a voluntarily chosen period T. Then the collimator's orientation (and the parameters V_α^m of the motion of the α-particles) relative to an unknown but constant direction of the ray L_{2ext} will be repeated with the period T. This will induce the similarity between the histograms $G_K(t)$ of the detector $D_{\alpha K}$ separated in time by period T, i.e., the following equality will be fulfilled:

$$G_K(t+T) \approx G_K(t)\,, \tag{9}$$

which usually has a clear narrow peak by the parameter δt^*. This similarity will be the indicator of the existence of the field F_{2ext}. In realized collimator experiences, the axis O_K is parallel to the Earth axis and, hence, has constant orientation relative to the system of "motionless" stars (which is accurate to small deviations). Therefore these experiences are suitable for the detection of the field F_{2ext}. These experiences were performed at the periods $T = \frac{1}{4}T_{ST}, \frac{1}{3}T_{ST}, \frac{1}{2}T_{ST}, T_{ST}$. For all the mentioned periods, the delineated (by δt^*) narrow peak of the histogram similarity (9) was disclosed [13]. Hence, *the field F_{2ext} exists**. Taking into account the physical model developed here, it is useful to determine the direction of the ray L_{2ext} and the force of the field F_{2ext}, making clear, first of all, whether it comes from the Galactic Plane or from some external source relative to the Galaxy. Many fields, such F_{2ext}, may indeed occur†. Therefore, one may

*At time T_{ST}, the detector returns to the same point in the GSC system. Therefore, if $T = T_{ST}$, the histogram similarity (9) is also caused by the Earth's field of the first type (see below). At $T = \frac{1}{4}T_{ST}, \frac{1}{3}T_{ST}$, the only parameter, which is repeated with the period T, is the collimator orientation relative to "motionless" stars and the ray L_{2ext}. Hence, at $T = \frac{1}{4}T_{ST}, \frac{1}{3}T_{ST}$ the histogram similarity (3) unambiguously occurs due to the existence of the field F_{2ext} that makes sense of the experiments with $T = \frac{1}{4}T_{ST}, \frac{1}{3}T_{ST}$.

†During a single day, the direction of the ray from remote planets relative to "motionless" stars is almost not changed.

expect to get an interesting and informative investigation result.

If the detectors A and B from equalities (1)–(3) and (5)–(7) are the plate-type detectors, $D_{\alpha P}$, let us denote them as $D_{\alpha PA}$ and $D_{\alpha PB}$, respectively. When they are the noise detectors, D_{noise}, let us denote them as D_{noiseA} and D_{noiseB}.

The existence of the field F_{2ext} explains the effects (1) and (3) in the experiments with the detectors $D_{\alpha P}$, since the orientation of the detector $D_{\alpha PA}$, in relation to the ray L_{2ext}, is repeated after the period T_{ST}, and the orientation of the detector $D_{\alpha PB}$ in relation to the ray L_{2ext} at the moment $t + \delta t_{ST}$ repeats the orientation of the detector $D_{\alpha PA}$ at the moment t (see Note 4 and Section 3).

If we do not neglect the orbital motion, the existence of the field F_{2ext} cannot explain the effects (1) and (3) in the experiments with the noise detector D_{noise} as, by virtue of equality (8), in the times δt_{ST} and T_{ST} there are no the corresponding repetitions of the directions of the detector's parameters V_d^m relative to the ray L_{2ext} because of the Earth's orbital motion. Probably, the effects (1) and (3) are generated in the noise detector by any other field (about this, see Section 5 "The disclosure and constancy of the type-one field F_1 along meridians").

By analogy, the disclosure of the type-two field F_{2S} of the Sun requires a periodical, with voluntarily chosen period T, variation of the orientation of the collimator $D_{\alpha K}$ in relation to the solar ray L_S passing through the detector $D_{\alpha K}$. But in practice, the period of the previous experiments may be used. For example, at $T = \frac{1}{4} T_{ST}$ the collimator is rotated in the plane of the local parallel (and, therefore, in the plane of the local celestial equator) with quadruplicated angular velocity of the Earth. Therefore the collimator almost exactly repeats its orientation in relation to the ray L_S in one forth of the solar day T_S. Indeed, in the experiments, the similarity of the histograms $G_K(t + \frac{1}{4} T_S)$ and $G_K(t)$ have been determined [13]:

$$G_K\left(t + \frac{1}{4}\, T_S\right) \approx G_K(t)\,. \tag{10}$$

In the time interval $\frac{1}{4} T_S$, nothing but ψ_α^m is repeated where ψ_α^m are the angles between the parameters V_α^m of the motion of α-particles and the solar ray L_S. As a consequence, the effect (10) is the result of the Sun's field impact, moreover, of the type-two field F_{2S}, because its impact depends on the above angles. The same is also confirmed experimentally at the repetition of the above angles during the time intervals $\frac{1}{3} T_S$, $\frac{1}{2} T_S$, and T_S. Thus:

The Sun's field of the second type F_{2S} and the active motion parameters exist.

Which ones are the active motion parameters? This has not been determined experimentally. At the time lapse of 529600 minutes, i.e., at the time of an integer number of the solar days nearest to the sidereal year $T_{SID} = 525969$ min, the orientations of the detectors $D_{\alpha P}$ and $D_{\alpha K}$ relative to the direction to the Sun are also repeated, and the histogram similarity should occur, too. The required experiments were performed with the plate-type detector $D_{\alpha P}$. The experiments demonstrate [14] the presence of the effect that is the additional confirmation of the existence of the field F_{2S}. The histogram similarity after the time lapse of 529600 minutes was detected accurate to within a minute. At the time of a solar day T_S, the orientation of the detector $D_{\alpha PA}$ relative to the ray L_S is repeated. Under the condition $\varphi_A(t) = \varphi_B(t) =$ const, the orientation of the detector $D_{\alpha PB}$ relative to the ray L_S at the moment $t + \delta t_S$ repeats the orientation of the detector $D_{\alpha PA}$ at the moment t.

Therefore, the existence of the type-two field F_{2S} of the Sun must lead to the effects (5) and (7) in the experiments with the detectors $D_{\alpha P}$ but only under the condition that the field F_{2S} is accurately, or sufficiently accurately, cylindrically symmetrical about the Earth's orbital axis, at least, in the orbital plane.*

The last condition is fulfilled because the effects (5) and (7) are indeed observed in the experiments with the detector $D_{\alpha P}$. Why is this condition fulfilled? The fact is that the experiment has confirmed (see below) the cylindrical symmetry of the type-two field of the Earth relative to the Earth's rotation axis. As a consequence, the Sun's field F_{2S} should be cylindrically symmetrical about the Sun's rotation axis. The rotation axis of the Sun is approximately normal to the Earth's orbit plane that leads to a sufficiently low deviation of the field F_{2S} from the cylindrical symmetry about the Earth's orbital axis. It is easier to study the field of the second type in the example of the Earth, because in relation to it the experiments are more accessible (with the reason presented below).

The field F_{2S} induces all effects (5) and (7), and in the experiments with the noise detectors.

Indeed, in the period of a Sun's day T_S, the orientation of the moving parameters $\mathrm{V}_d^m = \mathrm{V}_d^{SPIN,m} + \mathrm{V}_d^{ORB,m}$ of the detector D_{noiseA} relative to the solar ray L_S is repeated. Under the condition $\varphi_A(t) = \varphi_B(t) =$ const, the orientation of the moving parameters of the detector D_{noiseB} relative to the solar ray L_S at moment $t + \delta t_S$ repeats the moving parameters orientation of the detector D_{noiseA} that the last had relative to the ray L_S at the moment t. In this reason, the effects (5) and (7) arise as it will be shown shortly.

Does the Earth has its own field F_{2E} of the second type, cylindrically symmetrical relative to the Earth's rotation axis? The presence of the field F_{2E} may be checked experimentally, for whose purpose let us compose an appropriate experiment.

*The impact character of the field F_{2S} depends on both the said orientations and the field F_{2S} itself. If the field F_{2S} does not possess the said symmetry, it changes along the Earth's orbit, which prevents the occurrence of the effects (5) and (7).

By virtue of the cylindrical symmetry, the field F_{2E}, if it exists, comes from, as it were, from the Earth axis by the ray L_E perpendicular to the Earth axis (in the Earth's areas outlying from its poles). Let us use the noise detector D_{noise}. Then the impact character of the field F_{2E} on the detector should depend on the orientation of the active motion parameters $\mathrm{V}^m_{d,a}$ of the detector relative to the ray L_E passing through the detector. According to Note 3, the motion parameters should be considered in the GSC system.

> In the framework of Shnoll's technique, it is useless to fix a detector D_{noise} on the rotating Earth surface.

This is because in this case they will be moved in the GSC system along the motionless parallels $\varphi =$ const and have constant orientation and magnitudes of its parameters $\mathrm{V}^m_{d,a}$ relative to the ray L_E passing through the detector. Hence, the impact character of the field F_{2E} on each detector will be constant in time.

> Then, by virtue of Note 2, the Shnoll technique may not determine the existence of the field F_{2E}.*

Therefore, let us detach some detectors from the Earth's surface and begin to move them in the GSC system not in parallel to the motionless parallels $\varphi =$ const. Then in the GSC system, every detector $D_{noise,n}$ $(n = 1, 2, 3, \ldots, N)$ has time-dependent active motion parameters $\mathrm{V}^m_{d,a,n}(t)$. The detector D_n crosses the motionless parallel $\varphi =$ const at some point Q_n, at some moment of time t_n. Vectors $\mathrm{V}^m_{d,a,n}(t_n)$ are the active motion parameters of the detector $D_{noise,n}$ at the moments t_n of the intersections by the detector of the motionless parallel $\varphi =$ const, that is at the point Q_n. Let the following condition be observed: the points Q_n do not coincide among themselves; the magnitudes and orientations of the active motion parameters $\mathrm{V}^m_{d,a,n}(t_n)$ relative to the ray L_E passing through the detector $D_{noise,n}$ are the same for all detector $D_{noise,n}$. Under the condition, despite the differences between the points Q_n, the field F_{2E} impact character on all detectors at the moments of their crossing of the parallel $\varphi =$ const must be the same that should generate the appropriate histograms similarity. The histogram of the detector $D_{noise,n}$ timed to moment t will be denoted as $G_n(t)$. As a consequence, the following equality must be observed:

$$G_1(t_1) \approx G_2(t_2) \approx G_3(t_3) \approx \ldots \approx G_N(t_N)\,. \tag{11}$$

The particular case of the above described experiment with two detectors, that were detached from the Earth's surface and placed on board of the same aircraft flying to the north at a constant speed relative to the Earth's rotating surface, was performed in [12]. In principle, the detectors may be placed on board of different aircrafts, which fly differently, providing that the above conditions is observed. In [12], one detector was located northward from another. In the GSC system, the aircraft is shifted eastward by the Earth rotation. Therefore, in the GSC system, the detectors cross the parallel $\varphi =$ const at some different points Q_1 and Q_2. Obviously, the above conditions is observed. As a result, in these different points of the parallel, the expressed peak of the histograms $G_1(t_1)$ and $G_2(t_2)$ similarity (11) was really detected, i.e.:

$$G_1(t_1) \approx G_2(t_2)\,, \tag{12}$$

or, in other words:

> This fact experimentally confirms existence of the field F_{2E} of the Earth.†

If only the field F_{2E} does not change along the meridians, the similar histograms would occur equiprobably at different time shifts within the value $t_2 - t_1$, and the histogram similarity peak (12) would smears out and disappears (see Note 2). Hence, the field F_{2E} changes along the meridians. Not simple but useful is to broaden the experiment, as it is described above, for studying of the impacts' dependence on the values and directions of the detector motion parameters relative to the Earth's axis and the ray L_E passing through the detector.

> It is much simpler to perform these investigations in a laboratory by moving the detector relative to a rotating massive body, because the last must, as it will be seen, also generate the second type field and, since it is clear now how the detector should be moved to study the field impact.

By the opinion of experimenters, this experiment "confirms the hypothesis that the local time effect is induced by systematic motion in a heterogeneous alternating space" [12]. Contrary to the above opinion, this experiment bears no relation to the local time effect, but represents a new, long-awaited result [16], which experimentally confirms the existence of the Earth's field F_{2E} of the second type. The above experiment would relate to the local time effects, if the second detector in GSC enters the same point of the same motionless parallel, where the first detector has occurred before, i.e. if points Q_1 and Q_2 are the same, as required by the local sidereal time effect. By analogy, there is no relation to the local solar time effect.

5 The disclosure and constancy of the type-one field F_1 along the meridians

As is obvious, many in the effects (1)–(3) and (5)–(7) are explainable as results of the disclosure of the type-two fields. However, the existence of the type-two fields cannot explain

*The same also relates to detectors D_α with the orientation fixed relative to the LHP system, because in this case the detector orientation relative to the ray L_E do not change along the parallels.

†Obviously, $t_2 = t_1 + (t_2 - t_1) = t_1 + \tau$, where $\tau \equiv t_2 - t_1$. At any moment t_1, the first detector crosses some parallel $\varphi =$ const. Therefore, in the formula (12), the value t_1 can be changed by the current time t and present it as $G_1(t) \approx G_2(t+\tau)$. In [12], the value τ is constant. The same experiment could be performed with detectors $D_{\alpha K}$ observing constancy of the collimator direction relative to the ray L_E (and in a sufficient resolution power by time).

synchronism along the meridian (2), (6) in the experiments with the detector $D_{\alpha P}$. Actually, as is easy to see, the orientations of the plate-type detectors $D_{\alpha PA}$ and $D_{\alpha PB}$ (perpendicular to the plate) change along the meridians relative to the rays L_S, L_E, L_{2ext} and any other system of the ray mutually parallel within the bounds of the Earth. At the same time, the impact character of the type-two fields on the detectors $D_{\alpha PA}$ and $D_{\alpha PB}$ depends on the above orientations. Therefore, in the experiments with the detectors $D_{\alpha PA}$ and $D_{\alpha PB}$, the type-two fields of the Earth, the Sun and any other external source of them associated with the ray, mutually parallel within the Earth, may not generate the synchronism (2) and (6) on the Earth meridians. By analogy, regarding the orbital motion of the Earth, the existence of the type-two fields may not explain the effects (1) and (3) in the experiments with the noise detector D_{noise}. Hence:

> The different field does exist, the impact character of which is independent of the above orientations.

This field must affect the histograms of any Shnoll detector independently on the orientation of the parameters of its motion or the motions of the α-particles (for example, on the detectors $D_{\alpha P}$, $D_{\alpha K}$ and D_{noise}). The character of its impact depends exclusively on the field itself, on the detector location in this field and, probably, on the magnitudes of the above motion parameters. By definition, this is *the field F_1 of the first type*. The constancy lines of its impact character are the Earth meridians despite of the Earth's motion in space. Hence, this is the self-field F_{1E} of the Earth. If the field F_{1E} impact character would not vary and along the Earth parallels $\varphi = \text{const}$, it would be constants on the Earth's surface. Then there would be no reason for the raise of the probability of the similar histograms occurrences when two detectors are located on the same meridian. But, still, the indicated raise is observed. Hence, the field F_{1E} changes along the Earth parallels $\varphi = \text{const}$.

According to Note 1, the Sun must have its own field F_{1S} of the first type, the impact character of which in the HSC system is constant along of the Sun's meridians, but changes along its parallels motionless in the HSC system. The field F_{1S} should change along the Earth's orbit. If the field F_{1S} is static at a time in the HSC system, the character of its impact on the Earth should depend only on the Earth's location along the Earth's orbit. In the sidereal year T_{SID}, the Earth repeats its location in its orbit. A sidereal year is not equal to an integer of a sidereal day $T_{ST} = 1436$ min since in the sidereal year the Earth makes not an integer of its turnovers about of the Earth axis. Therefore, the detector's motion parameters and the motion parameters of the α-particles, if the detector is the radiation detector, at the moments $t + T_{SID}$ and t are directed differently. It is simple to convince ourselves that the angular difference in the directions on the equator attains approximately 90°. Despite of the indicated difference in the directions, if the Sun has a static field F_{1S}, the impact character of the field F_{1S} on the detectors D_{noiseA} and $D_{\alpha PA}$ should repeat in the sidereal year T_{SID}. Hence, the histogram similarity should be observed at the time T_{SID} under the effect of the field F_{1S} on the detectors. During the searching by S. E. Shnoll's group at about a year's cycle, the required experiment has been carried out but only with the detector $D_{\alpha PA}$ and with the use of many moments of a time t during several sidereal years [14]. In the experiments of Shnoll's group [14], the expressed peak of the similarity among the histograms divided by the interval $T_{SID} = 525969$ min has really been detected to one minute, which in addition experimentally confirms the existence of the first-type fields (of celestial bodies), their variability along motionless parallels and their *static character at a time*.

As we have illustrated earlier, in the GSC system at $\varphi_A(t) = \varphi_B(t) = \text{const}$, the detector D_{noiseB} at the moment $t + \delta t_{ST}$ and the detector D_{noiseA} at the moment $t + T_{ST}$ arrive at the same point where the detector D_{noiseA} was at the moment t and, therefore, arrive at the same point of the field F_{1E}. For this reason, the effects (1) and (3) should be in the experiments with the noise detectors as it is observed. Synchronism along the meridian is observed on the noise detectors. But the magnitudes of the motion parameter $\mathrm{V}_d^{SPIN,m}$ of the noise detector D_{noise} change along the Earth meridians — from zero value at the Earth poles to a maximum value on the Earth equator. Therefore field F_{1E} can generate synchronism along the meridian with the noise detectors only during the event when only the impact force, but not the impact character, of the first-type field F_1 depends on the magnitudes of the detector's motion parameters.

The effects (1) and (3) with the noise detectors are generated also by the exterior field F_{2ext} if it is possible to neglect the active parameters of the orbital motion. Indeed, in this case only the spin motion parameter $\mathrm{V}_d^{SPIN,m}$ of the noise detector D_{noise} relative to the Earth's center plays a rôle. These parameters of the noise detector D_{noiseA} repeat their orientation relative to the ray L_{2ext} at the time T_{ST}. A detector D_{noiseB} at the moment $t + \delta t_{ST}$ repeats the orientation of the parameter $\mathrm{V}_d^{SPIN,m}$ of the detector D_{noiseB}, which it previously had at the moment t. This way, it reduces to the effects (1) and (3). At any fixed moment t, the direction of each parameter $\mathrm{V}_d^{SPIN,m}$ does not change along the meridians. Therefore the field F_{2ext} should generate synchronism along the meridians (2) in the experiments with the noise detector D_{noise} but only if the impact force, but not the impact character, of the second-type field F_2 depends on the magnitudes of the detector's motion parameters (varying along the meridians). The ray coming from each point of the Sun (as well as the ray L_{2ext} of the external field) is practically mutually parallel in the Earth's limit (to five thousandth of a grade). Therefore the Sun's field F_{2S} also generates synchronism along the meridians in the experiments with the noise detector D_{noise} but only under the last condition.

Thus, in all cases, for the appearance of the above synchronism on the noise detectors it is necessary that only the impact force, but not the impact character, of the considered fields depends on the magnitudes of the detector's motion parameters. Synchronism along the meridians on the noise detectors is observed. Hence:

> At least for one of the fields F_1 and F_2, only the impact force, but not the impact character, depends on the magnitudes of the detector's motion parameters.

Now, let's ask ourselves whether it is possible to neglect the active parameters of the orbital motion? Probably — yes, if all active parameters are derivatives of the acceleration. In fact, the first derivative $\mathrm{V}_d^{ORB,2}$ of the detector's orbital acceleration with respect to the Sun makes only five ten-thousandth of the first derivative $\mathrm{V}_d^{SPIN,2}$ of the detector's rotational acceleration with respect to the Earth axis. With respect to the derivatives and the motion relative to the galactic center, a relation is not for the benefit of the latest. From the current experiments with the noise detector, it is not possible to draw a single one-valued conclusion concerning the rôle of the orbital motions as the active parameters have not been discovered.

6 About the reasons of the occurrence of the fields of the first and the second types

The field F_{2E} of the Earth is cylindrically symmetrical relative to the Earth axis. The Earth axis is the axis of its rotation. Hence the field F_{2E} is inseparably linked to the Earth rotation about its axis. If we stop the Earth rotation, the Earth axis loses its physical meaning and disappears and, consequently, the field cylindrically symmetrical relative to the Earth rotation axis loses its sense too. At the stopped Earth rotation, the field no longer has reason to be cylindrically symmetrical relative to the Earth axis. In this case, any other field may exist (with other properties) but not the above field F_{2E}. Consequently:

> The field F_{2E} arises as the result of the Earth rotation*.

The spatial distribution of the impact character of the field F_{1E} (as well as that of the field F_{2E}) is determined by the Earth's rotational characteristics — by its meridians $\theta = \mathrm{const}$ and parallels $\varphi = \mathrm{const}$. In fact, impact character of the field F_{1E} is constant along the Earth meridians $\theta = \mathrm{const}$ and changes along the Earth parallels $\varphi = \mathrm{const}$. So the field F_{1E} is also inseparably linked to the Earth rotation about its axis. At the stopped Earth rotation, the Earth poles, its meridians and parallels lose their physical meaning and disappear and, consequently, the field F_{1E} inseparably linked to the Earth meridians and parallels loses its physical meaning, too. At the stopped Earth rotation, the field has no reason to be linked to the Earth meridians and parallels. In this case, any other field (with others properties) may exist, not the above field F_{1E}. Hence:

> The field F_{1E} also arises as a result of the Earth rotation.

The origination of the field as a result of a material body's rotation may be checked by laboratory experiment. In one of the preceding paper of the author (2004), it is noted:

> "If a sphere or a disk first is rotated and then is stopped in a laboratory, the field generated by the rotation first will appear and then will disappear. Our interest is to register this phenomenon by the Shnoll detector and then study, in a laboratory, the characteristics of this field, its relations with rotation if, of course, the Shnoll detector will be sensitive enough, because the laboratory body mass is negligibly small compared with the masses of planets".

Based on the theory developed here, it is interesting to ask ourselves the following question: what must occur when the body is rotated in a laboratory with the angular velocity ω? As a result of a body's rotation, the fields of the first type, F_{1B}, and the second type, F_{2B}, must be generated. Let the position and the orientation of the detector $D_{\alpha P}$ be constant relative to a body's axis. When $\omega = \mathrm{const}$, the fields F_{1B}, F_{2B} and their the impacts character on the motionless detector are constant in time. At $\omega = \mathrm{const}$, by virtue of Note 2, the Shnoll technique gives no ability to detect impacts of the fields F_{1B}, F_{2B}, and

> An impression of the absence of the impact arises, although the detector itself registers the impacts of alternate and constant character.

If the impact character depends on ω value, upon multiple repetitions of the angular velocity with the period T, the impact character must repeat multiply, too†. Accordingly, the peak of similarity of the detector histograms $G(t)$ separated in time by the period T should occur: $G(t + \delta t) \approx G(t)$ at $\delta t = T$. The first appropriate experiment has already been performed with the detector $D_{\alpha P}$ [18]. The Shnoll detector had been found to be sensitive enough. The rotating massive body was accelerated from the angular velocity $\omega_{min} = 10\pi$ rad/s (300 rpm) to $\omega_{max} = 100\pi$ rad/s (3000 rpm). The acceleration and deceleration times were about one minute, and the rotation at the constant angular velocity $\omega = \omega_{max}$ lasted for about three minutes. This repeated many times every 5 minutes of the slow rotation at $\omega = \omega_{min} = \mathrm{const}$. Finally, the process periodically repeated every 10 minutes. During

*The Earth rotation forms and, most likely, generates the field F_{2E}. The point is that in all cases known in physics, if the field is formed by some motion, then it is also generated by this motion. These are intimately related to cases of the formation and generation of the magnetic field by moving electric charges, or to cases of the formation and generation of the so-called gravimagnetic, or co-gravitational fields of moving masses. For the consideration below of the field's dependence on motion, it does not matter, that the field is generated or formed by motion. It is important only that the field arises in the definite form as a result of the motion.

†If the impact character is independent of ω, at its voluntary changes the former false impression will be created.

the acceleration, the value of ω was increased from ω_{min} to ω_{max}, and during the deceleration the value of ω was decreased from ω_{max} to ω_{min}. As a consequence, the angular velocity ω multiply repeated, approximately, at the periods $T = 3 - 5$ min and $T = 5 - 7$ min. According to the developed theory, the similarity peaks of the histograms should be observed at these periods. More similar histograms should be observed at $T = 5$ min. But the greatest number of ω repetitions happens within the period $T = 10$ min, where the maximal peak of the histogram similarity should be expected. In accordance with the developed theory, in the first experiment the impression was created [18]:

> "...that the recording system is sensitive not to the presence or absence of the rotor's centrifuge rotation, but to its acceleration or deceleration".

Secondly, the similarity peak of the histograms was detected within the interval $\delta t = 3 - 7$ min with the maximum at the time shift δt about $\delta t = 5$ min (see Fig. 10a in Ref. [18]). In accordance with the process' cyclicity, the highest peak is observed for the shear $\delta t = 10$ min (see Fig. 10a in Ref. [18]). Despite the obviousness, the authors of the work [18] have spoken about the appearance of the "*five-minute period instead of expected ten-min period*". They came to the inexact conclusion because of the application of the Fourier transform to the curve of numbers of the similar histograms with respect to the shear δt between histograms (see Fig. 10b in [18]). However, the maximum at the shear $\delta t = 10$ min already indicates the maximal repetition of the histogram shape separated by the interval $\delta t = 10$ min. Therefore, to detect repetition of the histogram shape in the interval $\delta t = 10$ min no Fourier transform is needed. The Fourier transform indicates another: it indicates that at the time 5 minute the peaks on the above curve repeat. These peaks are present at $\delta t = 5$, 10 and 15 min. As a result, the Fourier transform mixes the physically miscellaneous peaks and gives the spectrum its maximum at the frequency corresponding to the period of the peaks' repetition 5 min. This has no relation to the sought interval of the histogram shape repetition*. Moreover, it may be shown that in the considered experiment, the quasistationary rotation takes place, i.e., the angular acceleration is so low that it does not affect the instantaneous linear velocity, acceleration and accelerational derivative of the rotating body's points. Indeed, let point M rotate at a variable angular velocity ω. Then it is clear that vectors of its linear velocity v, linear acceleration a and accelerational derivative a' in time are defined by the expressions:

$$\mathrm{v} = [\omega, \mathrm{r}]\,, \tag{13}$$

$$\mathrm{a} \equiv \mathrm{v}' = \big[\omega, [\omega, \mathrm{r}]\big] + [\omega', \mathrm{r}]\,, \tag{14}$$

$$\begin{aligned}\mathrm{a}' \equiv \mathrm{v}'' = \Big[\omega, \big[\omega, [\omega, \mathrm{r}]\big]\Big] + \big[\omega, [\omega', \mathrm{r}]\big] + \\ + 2\big[\omega', [\omega, \mathrm{r}]\big] + [\omega'', \mathrm{r}]\,,\end{aligned} \tag{15}$$

where ω is the angular velocity vector, "prime" is signed for time derivative, square brackets denote vector cross-product, and r is the radius-vector of the point M relative to the axis of rotation. For the stationary rotation case, $|\omega'| = |\omega''| = 0$. Therefore, linear parameters v, a, a' of the stationary rotation are described by the first summands in the right part of the formulas (13)–(15). The rest summands containing ω' and ω'' values describe the correction arising from the rotation's unevenness. For the purpose of estimation, let us suggest that $|\omega'| = \frac{\omega_{max} - \omega_{min}}{60 \text{ sec}} = \frac{3\pi}{2}$ rad/s^2. For example, at $\omega = \omega_{max}$, we get

$$\Big|\big[\omega, [\omega, \mathrm{r}]\big]\Big| = (\omega_{max})^2\,|\mathrm{r}| = (10000\pi) \times \pi|\mathrm{r}|\,, \tag{16}$$

$$\big|[\omega', \mathrm{r}]\big| = \frac{3\pi}{2}\,|\mathrm{r}|\,. \tag{17}$$

Therefore, the second sum in (14) is $\frac{10000 \times 2\pi}{3} = 20943$ times smaller in absolute magnitude than the first summand, and may be neglected. The linear acceleration a is determined by the first summand and equals that of the stationary case. As is estimated, the same is true for other values of ω and a'. Therefore, it shall be reasonably assumed that the results of this experiment indicate the effects of rotation, but not acceleration or deceleration of rotation. Thus:

> The experiment confirms formation of the field as a result of the body's rotation and discloses the presence of the impact character dependence on the angular velocity. Hence, at least for one of the fields F_1 and F_2, the impact character depends on the magnitudes of the motion parameters of the field source, and, by the principles of relativity and reciprocity, also from the magnitudes of the motion parameters of the detector.

Then we obtain the analogy of an electromagnetic field impact on an electric charge — the electric field's impact does not depend on the velocity of the charge, and a magnetic field's impact depends on the magnitude and direction of the velocity of the charge. If we trust this analogy, there should expectedly be a mutual induction of fields F_1 and F_2. The axis $O_{\alpha P}$ of the detector $D_{\alpha P}$ has been directed to the body's rotational axis in the above circumscribed experiment. In another experiment, the detector has been turned on. Its axis was parallel to the body's rotational axis. As a result, the produced histograms, which form a response to the body's rotation, has disappeared [18]. The impact character of the field F_1 does not depend on the turns of the axis $O_{\alpha P}$ of the detector $D_{\alpha P}$. Therefore the effects of its action cannot disappear at the turns of the detector $D_{\alpha P}$. At the turns of the detector $D_{\alpha P}$, the action of only the field F_2 varies. Hence,

*If a multitude of other variable impacts did not interfere, obviously, the similarity peaks would also be observed at $\delta t = 20$, 30, 40 min, etc. (see Note 1). In this case, the Fourier transform would have physical meaning and give the peak at the frequency corresponding to the period 10 min. The cutoff of the transformed curve at time $\delta t = 26$ min and the said interference, naturally, do not render the peak at the above frequency possible, and simply mix the physically miscellaneous peaks.

the response of the detector in the first experiment is the result of the impact of the field F_2. Consequently:

> The impact character of the field F_2 depends on the magnitudes of the motion parameters of the source and the receiver, and the impact character of the field F_1 does not depend on these magnitudes. Only the impact force of the field F_1 can depend on these magnitudes.

And, the impact of the field F_2 of a rotating body disappears or the impact character of the field F_2 does not depend on the motion parameters of the source when the detector axis $O_{\alpha P}$ is parallel to the rotating body axis. These conclusions are obtained by the supposition that the detector records directly the fields F_1 and F_2 generated by the rotation. However, in it there is some doubt. The rotating body mass is very small in comparison with the masses of the planets. Probably, the rotating body generates the fields $F_1$and F_2 so weakly, that the detector is not capable of registering them. On the contrary, the speed of the variations (changing) of these fields in the experiments are unusually great on planetary scales, i.e., in comparison with the speed of the variations (changing) of such fields of the Earth, or of the remote planets. Therefore, probably, there are enough strong fields of an induction (induced by weak, but sufficiently fast varying fields of the rotating body) which are registered with the detector. Then essential conclusions can vary. Therefore:

> In the development based on such experiences, it is useful experimentally "to study in a laboratory the performance of the investigated field", especially by the collimator detector $D_{\alpha K}$, to investigate in a laboratory the relation between the field's impact force and character on the location and the motion parameters of the source and the detector, to study the effects of the local-time type and a possible mutual induction of fields F_1 and F_2.

In order to detect the field's existence at $\omega = \mathrm{const}$, it is possible to move the detector.

The formation of the field F_{2E} as a result of the Earth rotation gives birth to consequences chain. The field F_{2E} of the entire Earth formed by rotation should be composed of the elementary fields F_{2P} of the material points P of the Earth. The material points P move around the axis of the Earth. Hence, the whole field F_{2E} is composed of its elementary components F_{2P} arising as a result of the cyclic motions of the material points P around the Earth axis (similar to how a magnetic field is generated by the motion of an electric charge). At any fixed moment of time t, a (sample) material point P is located not at all points of its cyclic orbit around the Earth axis, but at some fixed point K of its orbit. At the moment t, at the point K, the field F_{2P} is formed, naturally, not due to the general characteristics of the motion of the material point P on its whole orbit, but due to the local characteristics of its motion at the point K at the moment t, i.e., at least due to some active, parameter $\mathrm{V}^m_{P,a}$ of the motion of the point P from the set $\{\mathrm{V}^m_P\}$, where $m = 0, 1, 2, 3, \ldots$; V^m_P is the m-th derivative of the velocity V_P of the material point P, $\mathrm{V}^0_P \equiv \mathrm{V}_P$. The significant task for the physical experiment is to find out what the parameters of the motion of the (sample) material point are active and how the field F_{2P} depends on them. Now, in general terms, the following can be said: if some component of the field arises as a result of a motion, then its intensity must depend on the motion's intensity, i.e., on the value of the active parameter $\mathrm{V}^m_{P,a}$, and, for the total field F_{2E} of the entire Earth, on the angular velocity of the Earth rotation. The Earth is moving along its orbit around the Sun. Therefore, the motion of the material points P along the Earth orbit must lead to the formation of some field F^{ORB}_{2E}which we shall denote as the *orbital* field of the Earth. We will distinguish it from the Earth's field formed due to its self-rotation about its axis, which is called the *spin* field and denoted as F^{SPIN}_{2E}. Analogously to the orbital motion, the internal motions of the material points of the Earth (the motions of tectonic plates, subcortical melt, water flows, etc.) must lead to the formation of the field F^{IN}_{2E}, which we will denote as the field of the internal motions of the Earth. The Earth is only one of many planets. Then the said must be true for other planets, their satellites, the Sun, the Moon and for other celestial bodies, because all of them consist of material points, have orbital, spin and internal motions, i.e., all celestial bodies must have orbital, spin fields and fields formed by their internal motions. This is in accordance with NOTE 1. Any sample (a motionless one included) of matter consists of physical material particles (molecules, atoms, etc.) which are mobile. Hence, any sample of matter has the same fields. By the same logic, the same consequences chain for the field F_{1E} are obtained. In particular, the field F_{1E} of the entire Earth is composed of elementary field F_{1P} of the material points P of the Earth. Consequently, the above conclusions about relation between the *type-two* fields and the motions of their sources are also true for the *type-one* field. Then the Earth has a spin field, F^{SPIN}_{1E}, and an orbital field, F^{ORB}_{1E}, of the first type, as well as the type-one field F^{IN}_{1E} formed by the internal motions of the Earth. The impact character of the field $F_P = F_{1P} + F_{2P}$ depends on the magnitudes of the active parameters of the motion of the material point P, since for the entire Earth it depends on ω.

7 Conclusions and discussion

From the experimental material accumulated by Shnoll's group, the following physical model is logically succeeded. The Shnoll detector records the fields of two types. The impact character of the second-type field F_2 displayed by the histogram shape depends on the orientation of the active parameters of motion of the object relative to the ray by which the impact arrive at the object. The impact character of the first-type field F_1 does not depend on the above orientation. The motion of the material particles P leads to the simultaneous formation of the type-one field F_{1P} and type-two field F_{2P} of the particles. Therefore, the fields F_{1P} and F_{2P} may be considered as the components of the single field $F_P = F_{1P} + F_{2P}$. The intensity of the fields F_{1P} and F_{2P} should depend on the intensity of the motions, i.e., on the active parameters of motion of the particles P. The impact character of the field $F_P = F_{1P} + F_{2P}$ depends on them, too. The material particles of the Earth are moving around the Earth axis and, as a result, form the Earth's total *spin* fields of the first type, F_{1E}^{SPIN}, and the second type, F_{2E}^{SPIN}. In the geocentric coordinate system, GCS, (non-rotating relative to "motionless" stars), the impact character of the field F_{1E}^{SPIN} is constant along the motionless meridians $\theta = \text{const}$ of the Earth but changes along its motionless parallels $\varphi = \text{const}$. The field F_{2E}^{SPIN} is cylindrically symmetrical about the rotation axis of the Earth. Its impact character is constant along the parallels $\varphi = \text{const}$ and changes along the meridians $\theta = \text{const}$. The motion of the Earth's particles, as of a single whole, along the Earth's orbit forms *orbital* fields of the Earth of the first type, F_{1E}^{ORB}, and the second type, F_{2E}^{ORB}.

> The motion of tectonic plates, subcortical melt, water flows, etc. form the fields F_{1E}^{IN} and F_{2E}^{IN} of the Earth's internal motions of both types.

The measure of the relative strength of the considered fields may be the probability of the appearance of similar histograms by the considered field effect. This allows a change over from a qualitative estimation to a quantitative estimation of the field. The Earth is only one of many planets. Other planets, their satellites, the Sun, the Moon and other celestial bodies must have the same fields. The study of the results of the experiments performed with the Shnoll detector has allowed us to uncover the existence of the first and second-type fields of the Earth and the Sun, as well as the field F_{2ext} of the second type external to the Solar system, the ray of which is reciprocally parallel within the Earth's orbit. Any sample (including a motionless one) of matter consists of mobile material particles (molecules, atoms, etc.) and possesses the same fields. According to S. E. Shnoll's opinion [14], his detector, per se, detects fluctuations of local space-time properties. If S. E. Shnoll is right, the physical nature of the above-studied field F displays itself in the form of fluctuations of local space-time properties (just as the gravitational field displays itself in the form of space-time distortion). Then the statistical properties of the body's internal motions should affect the statistical character of the space-time fluctuations, induced by this body. The inverse effect should also take place, i.e., there should be an interaction between the statistical phenomena in the body and in space-time. The studied aggregate field $F = F_1 + F_2$ of the Sun, the Earth, the Moon, planets, and other material bodies should also depend on the microscopic motions of microscopic particles, for instance, on temperature and spin motions of their atoms. Therefore, the aggregate field F of any material body should depend not simply on its mass, but also on its substance, structure and processes occurring in it.

One would think, that it doesn't matter which Shnoll detector is used, since the histograms of the processes of different physical natures are similar and changed synchronously. Nevertheless, in this paper a different physical meaning of the experimental data of the detectors of the different types is determined: the noise detector D_{noise} indicates dependence of the impact character on the active vectorial parameters of the motions of the detector and the points of the Earth, but the detectors D_α, based on the α-decay registration, indicates dependence of the impact character on the active vectorial parameters of the motion of α-particles. Correspondingly, if the dependence of the impact character and the histogram shapes on the directions of motion parameters or on the spatial orientation of the detector is studied, the method for the interpretation of the experiments with the detector D_α must always be different from the method for the interpretation of the experiments with the detector D_{noise}, which has not been taken into account in the works [10–14]. Taking into account the last conclusion, the system of experimental data of the Shnoll detector and the specific rôle of the experiments with the rotating collimator $D_{\alpha K}$, cutting off the pencils of α-particles, become clear. In the framework of the developed physical model, the effects of local time (1), (3), (5), (7) and near-year cycle with the period of 529600 minutes, observed on detectors D_α, are the theoretical consequences of the experiments resulting from performance of the rotated collimator $D_{\alpha K}$, in which the Sun's second-type field F_{2S} and the external field F_{2ext} has been disclosed. Naturally, this is the reason for the recommendation to use the detectors D_α and $D_{\alpha K}$ for studying of the angular diagram of the type-two field impact upon their laboratory generation. In particular, as described in this paper, with the detectors D_α and $D_{\alpha K}$ rotating on different planes, it is desirable to study the character and relative strength of the impact, and the directions of the ray of the type-two field. The laboratory experiments may allow us more reliably to determinate the details of the properties of the fields of both types. For instance, the already performed laboratory experiment has confirmed the theory's conclusions about the field generation by rotation and has disclosed the disappearance of the response of the plate-type detector $D_{\alpha P}$ to the body's rotation within the detector's orientation along the rotational axis [18]. This is in accordance with an experiment, in which the collimator is parallel to the Earth's rotational axis. The Moon rotates about its axis 28 times slower than the Earth. Therefore, the detection and study of the Moon's type-two field may answer the following question: what changes, if the rotational velocity is strongly decreased?

In the nearest future, the influence of macroscopic internal motions of the Earth on the aggregate two-component field F_E of the Earth may gain direct practical importance for the purpose of the detection of hidden water flows, motions of tectonic plates and subcortical melt, forecasting of strong earthquakes, etc. According to seismology, earthquakes happen as a result of collision in the Earth's crust of large plates floating on the underlying melt. Let us briefly consider earthquakes themselves. During an earthquake, a short-term (pulse) motion and displacement of large masses of the Earth's crust arise. Then, by virtue of our theory, a pulse change of the field of the mentioned masses arises and, therefore, a pulse change of the Earth's field $F_E^{IN} = F_{1E}^{IN} + F_{2E}^{IN}$ arises too. That is why the Smirnov (and Shnoll) detectors should detect earthquakes, being integral recorders of the motions and displacements of masses. The precursors' appearance in indications of the Smirnov detector before 2–10 days of the earthquakes means, apparently, that some pulse changes in the motions or displacements of the large masses of the Earth's crust or subcortical melt happen also and 2–10 days prior to a strong earthquake that may be, for example, due to the mechanism in which the mentioned plates come into sufficiently rigid contact and, as a result, they are sufficiently abruptly decelerated. Therefore, the presence of earthquake precursors in the field F_E is not surprising and seems logical. However, the precursors' strength is unexpected. The Smirnov detector goes off scale, and it requires us to reduce the detector's sensitivity. Now the precursors of strong earthquakes are separated exactly by anomalously high amplitudes (and with the duration increased, approximately, up to 12–13 minutes). The reason of the mentioned anomalous strength of the precursors' amplitudes may be due to the induction of a strong field due to relatively quick changes in the motions and positions of the tectonic plates or melt. Frequently, in physics, the following rule of reciprocity is true: if some physical process generates or changes some field then, vice versa, this field or its changes may influence the behavior of this process. As a result of the seismic motions, the aggregate two-component field is formed and changed. Seemingly, the reciprocity rule is realized in the connection between such fields and earthquakes, i.e., the fields affect the Earth's seismicity. Moreover, if planets, the Sun and the Moon affect the motions on the Earth via their own aggregate two-component field F, which has been disclosed by the Smirnov detector, then there are serious foundations for the supposition that they also affect the Earth's internal motions related to the earthquakes. This is directly confirmed by the detected correlation between microseismicity and planetary motions. In favor of the same, the old data of Ben-Menachem state the correlation between microseismicity and sunrises and sunsets. According to the Smirnov detector's data, the strong splashes of the field F of the Sun and planets occur exactly at risings, settings and culminations. (Incidentally, the Sun's gravitational impact is minimal exactly at sunrises and sunsets.) This also explains the Jupiter splash affecting in living matter immediately at its upper culmination. Actually, the system of such splashes is much wider. In particular, the strong short-term splashes happen at pair-wise connections between planets, the Sun and the Moon on the coelosphere and at their crossing of their network's definite lines, which will be discussed in a separate paper. Therefore, a strong correlation between earthquakes and the connection between the Moon and planets, observed by T. Chernoglazova, becomes natural. The data on the effects of the pulsar on the Earth's seismicity indicate a noticeable long-range action of the considered fields. Generally, the outlined effects of planets and the pulsar on seismicity and terrestrial motions indicate the existence of the long-range action fields.

However, astrophysics firmly states one's position: *planets are unable to impact the Earth*. These are not mere words. Actually, the total energy flow of a field (known or still unknown to us) through its frontal area must be constant and must be spread throughout the frontal area. The frontal area increases with respect to r^2 (in the case of its spherical shape, where r is the distance from the point-source of the field). Finally, the energy-flux density of the field together with the field intensity should decrease with respect to $1/r^2$ or faster. The corresponding numerical estimates lead astrophysics to the said position. However, astrophysics keeps back the following: *the position is correct for the class of energy fields*. Scientific experiments and observations demonstrate the impact of planets and pulsars on the Earth. Therefore, the dilemma arises: either astrophysics is right in the class of energy fields, then consequently there are the fields outside this class (by definition, they are the energy-free fields) or astrophysics is not right. The known physical laws do not prohibit the existence of the energy-free impacts and fields. Moreover, from physics it is known that energy-free impacts exist. These energy-free impacts do not change the energy of the process but merely control its development, for example, turning on and off energy transforms from one of its kind to another [16]. As is mentioned in the Introduction, S. E. Shnoll has disclosed some universal, remote non-energy impact synchronously affecting on processes of different physical nature. That is, some substance — some physical field — does exist, which is transferring these non-energetic impacts. In order not to conflict with the mentioned position of astrophysics and the conservation law of energy, this field itself must be of non-energetic nature. Though the above idea about a non-energetic field is unusual, it should be seriously investigated, as it is the result of experiments and generally recognized scientific views of astrophysics.

At the same time, the developed theory here does not disclose the physical nature of the fields. This theory is valid independently of whether the fields are energetic or energy-free, electromagnetic, gravitational or of any other physical nature. This theory just gives the field properties as the logical consequence of the experimental material and independently of their physical nature. Therefore, as A. A. Artamonov has reasonably noted, this theory may be included as an independent block for any future theory attempting to explain the properties and the physical nature of the considered fields.

In the interrelation between the considered fields and seismicity, significant are not only new prospects in the forecasts of earthquakes. Most likely, higher importance is attributed to the renovated view on the physical model of evolution and the interdependence between seismic processes themselves and the surrounding cosmos [19]. The renovated view arises also on geopathogenic zones, as on the zones of anomalies of the considered fields since, according to the above theory and other observations, these fields affect the state of living systems, that will be discussed in a special paper.

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