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# Physical Process Defining the Properties of Cavity Structures with Taking into Account the Properties of Physical Vacuum

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**ABSTRACT**

The aim of this article is to prove that energy properties of cavity structures (impact on technical devices, biological systems, other cavity structures) is carried out by spin supercurrent.

The spin supercurrent arises between spins of virtual photons (spin vortices) created by quantum objects constituting a cavity structure. The concept of virtual photons was developed by a Nobel Prize Winner R. Feynman in 1949; one of the properties of virtual photons is their ability to interact with each other by spin supercurrent. A significant feature of a cavity structure is the conservation of properties of a cavity structure for several hours or even days after removing it from any area of the physical vacuum. This phenomenon is explained by the properties of physical vacuum. According to a study by Planck, Einstein and Stern, a physical vacuum free from magnetic and electric fields (without regard to gravitational energy) should be defined not as an empty space but as a state of a field that consists of some oscillators with "zero-point energy" called in this work as quantum oscillators. The quantum oscillators have precessing spins and spin supercurrent may arise between their spins, and by such way to determine "residual effect" of cavity structures.

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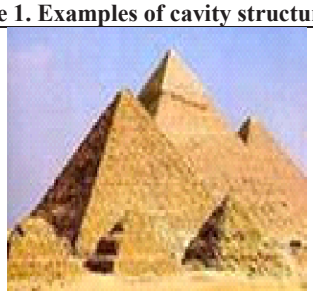
## Introduction

**Figure 1. Examples of cavity structures**



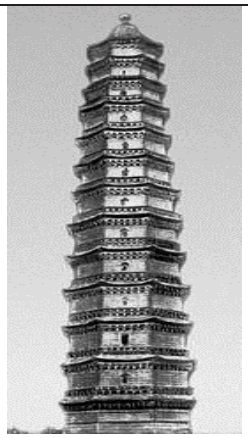
The Pyramids of Giza in Egypt, XXVI—XXIII BCE

A round pyramid with a nonrectangular base. Guachimontones, Mexico, 300 BCE - 500 CE.

A honeycomb.

Yakushiji Monastery, Nara, Japan 7-8th centuries.

The Orthodox Church, 18th century.



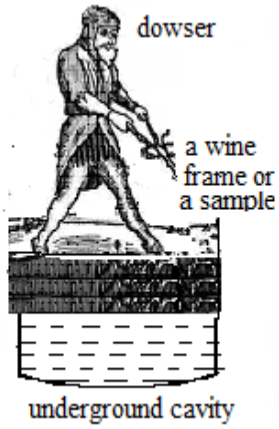
Pagoda Teta Kaifeng China, 1049.

Stacked emitters (hemispheres).

## The main properties of cavity structures

**1**. The energy properties.
In 1965, researchers of cavity structures Léon Chaumery and André De Bélizal proposed the term "the radiation of form" [1]. However, some experiments show evidence of inaccuracy of this term.

Example.
Experiment: a search for an underground cavity by a dowser [2].




A maximum search efficiency of an underground cavity takes place when a dowser holds a sample of the substance contained in the underground cavity: for example, a test tube with oil, if oil underground deposits are being searched for, or a piece of wood if one is looking for wooden underground structures [3]. There is no requirement of similarity of forms of the sample and cavity structure.

Note. The above-mentioned resonant phenomenona indicate the presence of a frequency component in the energy characteristics of the cavity structure.

**2.** Pyramids are characterized by the "residual effect" [1, 4]. This effect may be considered as a consequence of inertial properties of physical vacuum, and these properties are due to the processes that occur between the spins of objects that make up a physical vacuum [5].

Let us consider these processes in detail.

## I. The Properties of Physical Vacuum

**1)** In 1913, using the formula derived by Planck [6] for the energy $\varepsilon_o$ of the atomic oscillator vibrating with frequency $\nu$: $\varepsilon_o = h\nu/2 + h\nu/\left(\exp\left(h\nu/\left(kT\right)\right)-1\right)$, Einstein and Stern published a paper [7] in which they classified $h\nu/2$ as "residual energy" (later, "residual energy" was called "zero-point energy") that atomic oscillator has at T=0K:

$$\varepsilon_o = h\nu/2. \qquad (1)$$

In quantum field theory, a physical vacuum free from magnetic and electric fields (without regard to gravitational energy) is defined not as an empty space but as the ground state of a field that consists of some oscillators with "zero-point energy" [8]. These oscillators have no generally accepted name but, in this work, they are called "quantum oscillators" (from now on the abbreviation "*qo"* will be used).

**2)** The total angular momentum of photon (**J**) radiated by an atom equals the sum of the spin (**S**) and orbital (**L**) angular momenta: **J = L + S**. At the same time, atom in energy transition transmits to the

resulting photon only orbital angular momentum **L** [9, 10]. Consequently, the spin of photon $\mathbf{S} \neq 0$ is created by spins $\mathbf{S}_{qo}$ of quantum oscillators (as components of the photon), that is:

$$\mathbf{S}_{qo} \neq 0 . \tag{2}$$

**3)** The electric polarization of physical vacuum in electric field is the evidence of the presence of electric properties of quantum oscillators, in particular, such property as electric dipole moment of quantum oscillator, $\mathbf{d}_{qo}$, that is:

$$\mathbf{d}_{qo} \neq 0 . \tag{3}$$

**4)** In the physical vacuum with above-considered properties, an effect similar to that of the Barnett effect (Barnett S. J.) may occur [11].

According to the Barnett effect, the rotation of magnet results in the orientation of its electron spins $\mathbf{S}_e$ in the direction **opposite** to the angular velocity $\boldsymbol{\Omega}$ of rotation; that is, the precession of electron spins $\mathbf{S}_e$ arises with frequency $\boldsymbol{\omega}_e$ determined as:

$$\boldsymbol{\Omega} \uparrow\uparrow \boldsymbol{\omega}_e . \tag{4}$$

*Note.* Eq. (4) is in accordance with the properties of gyroscope [12]: $\mathbf{M} = \boldsymbol{\omega} \times \mathbf{S}$, where $\mathbf{M}$ is the moment causing the precession of spin $\mathbf{S}$ with frequency $\boldsymbol{\omega}$.

Spin $\mathbf{S}_q$ of a quantum object may cause the processes in physical vacuum characterized by Eqs. (2) and (4). Phenomena similar to that of the Barnett effect: uniform orientation of spins of quantum oscillators $\mathbf{S}_{qo}$ arise in physical vacuum (see Fig. 2).

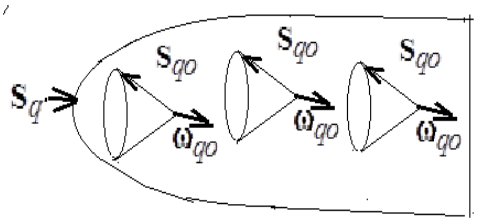



**Fig. 2**. The characteristics of physical vacuum under the action of spin $\mathbf{S}_q$ of a quantum object. $\mathbf{S}_{qo}$ are spins of quantum oscillators; $\boldsymbol{\omega}_{qo}$ is a frequency of precession.

Thus, it follows from Figure 2 that spin vortex with spin $\mathbf{S}_v = \sum \mathbf{S}_{qo}$ with frequency $\boldsymbol{\omega}_v \approx \boldsymbol{\omega}_{qo}$ emerges in physical vacuum; according to properties (4):

$$\mathbf{S}_q \uparrow\uparrow \boldsymbol{\omega}_v . \tag{5}$$

According to Eq. (3), a quantum oscillator has an electric dipole moment $\mathbf{d}_{qo}$; consequently, spin vortex has electric dipole moment $\mathbf{d}_v = \sum \mathbf{d}_{qo}$. As shown in [13], electric dipole moment $\mathbf{d}_v$ of a virtual photon is related to its spin $\mathbf{S}_v$ as:

$$\mathbf{d}_v \uparrow\uparrow \mathbf{S}_v . \tag{6}$$

The electric field of a quantum object acts on a virtual photon (as on electric dipole) which is produced by this object and is following it. Consequently, the orientation of the electric dipole moment of a virtual photon is determined by the sign and direction of velocity **u** of the quantum object that creates the virtual photon. Thus, with taking into account the equations (5) - (6) and properties of gyroscope we have:

$$\boldsymbol{\omega}_v \uparrow\uparrow \eta \mathbf{u}, \tag{7}$$

$$\text{where } \eta = \begin{cases} 1, \textit{ for positively charged quantum object} \\ -1, \textit{ for negatively charged quantum object} \end{cases} .$$

The above-considered properties of spin vortex coincide with properties of virtual photons, the existence of which was proposed by R. F. Feynman in 1949 [14] (Nobel Prize Winner). The diagram of virtual photons is given in Figure 3.

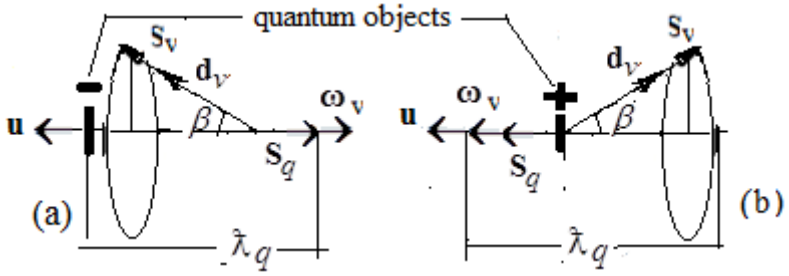



**Fig. 3.** A diagram of virtual photons created by a negatively charged quantum object (case (a)) and positively charged quantum object (case (b)). $\mathbf{S}_q$ are spins of quantum objects; $\boldsymbol{\omega}_v$ - frequencies of precession of spins of virtual photons $\mathbf{S}_v$; $\alpha$ - angles of precession; $\beta$ - angles of deflection; r.l. – reference lines; **z** – axis; $\mathbf{d}_v$ - electric dipole moments; $(I_{SS})_z$ - spin supercurrent; **u** – velocities of quantum objects; $\bar{\lambda}_q$ is the wavelength of wave function of quantum object.

The angle of deflection $\beta$ is determined by the speed *u* of the virtual photon (which is the same as the speed of the quantum object which creates this virtual photon) and by the speed of light [13]:

$$\sin\beta = u/c. \tag{8}$$

It follows from equation (8) that at *u*=*c* a virtual photon converts into a "real" one. The existence of the Cherenkov effect [15] proves the validity of equation (8).

**5**) The wave properties of a virtual photon. According to Feynman's hypothesis, the size of a virtual photon equals wavelength $\bar{\lambda}_q$ of wave function of a quantum object which creates this virtual photon. Consequently, other characteristics of a virtual photon may be determined by the characteristics of wave function of the quantum object which creates this virtual photon. For example, the frequency $\omega_v$ of precession of the spin of a virtual photon equals the frequency of wave function of this quantum object and, consequently, in accordance with Schrodinger equation [16], $\omega_v$ is determined by energy $U_v$ of a quantum object:

$$\omega_v = U_v / \hbar, \tag{9}$$

where $U_v = m_q u^2 / 2 + \mu_q \mathbf{H} + k\boldsymbol{\Omega}_q$; $m_q$, $u$ and $\mu_q$ are respectively mass, speed and magnetic dipole moment of a quantum object; **H** – external magnetic field; $\boldsymbol{\Omega}_q$ - the angular velocity of the external rotation; *k* - proportionality coefficient.

## II. The spin supercurrent

Maxwell J. C. in 1861 put forward a hypothesis about the existence of the process of transformation of angular momentum [17]. The first attempt to describe the phenomenon of a long transport of spin polarization (spin supercurrent) was made by Vuorio in 1976 [18].

In the following years, the spin supercurrent was studied in experiments with superfluid $^3$He-B by Borovik-Romanov [19] - [21]. In these experiments, a spin supercurrent occurred between regions with identically oriented and coherently precessing spins of $^3$He atoms. Let us consider the features of a spin supercurrent.

### (1) Definition.

The value of a spin supercurrent is determined by the following characteristics of the precession of spins of the virtual photons between which the supercurrent arises: the mutual orientation of their precession frequencies, precession angles (phases of precession) $\alpha$, and deflection angles $\beta$. For example, the value of spin supercurrent $(I_{ss})_z$ in the direction of the orientation (axis *z*) of the precession frequencies is determined to be:

$$(I_{ss})_z = -g_1 \partial\alpha / \partial z - g_2 \partial\beta / \partial z, \tag{10}$$

where $g_1$ and $g_2$ are coefficients depending on $\beta$ and the properties of the superfluid.
A diagram of the above-mentioned variant of spin supercurrent is given in Figure 4.

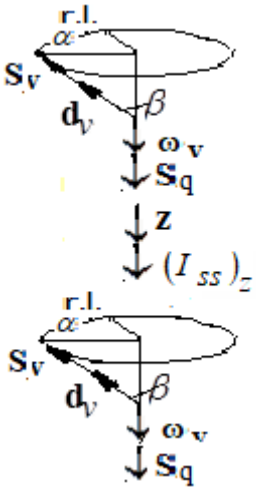



**Fig. 4**. The characteristics of virtual photons created by quantum objects with spins $\mathbf{S}_q$ oriented in one direction. $\boldsymbol{\omega}_v$ - frequencies of precession of the spins of virtual photons $\mathbf{S}_v$; $\alpha$ - angles of precession; $\beta$ - angles of deflection; r.l. – reference lines; **z** – axis; $\mathbf{d}_v$ - electric dipole moments; $(I_{ss})_z$ - spin supercurrent.

The spin supercurrent $(I_{SS})_z$ may occur between virtual photons with antiparallel oriented frequencies of precession $\boldsymbol{\omega}_v$ (see Fig. 5):

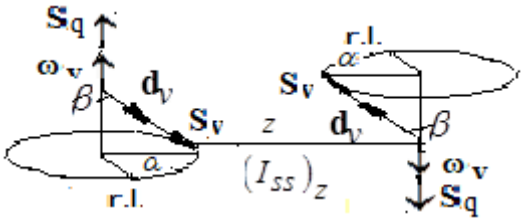



**Fig. 5**. The characteristics of virtual photons created by quantum objects with spins $\mathbf{S}_q$ oriented in the opposite direction. The rest of descriptions in Figure 5 are the same as in Figure 4.

Due to the interaction of electric dipole moments ($\mathbf{d}_v \cos\beta$) of virtual photons, an attractive force is present between virtual photons shown in Figures 4 and 5.

**(2) The phase slippage (drop).**

At the critical difference $\Delta\alpha = \Delta\alpha_c$ of the angles of precession, the critical spin supercurrent $(I_{SS})_z^c$ corresponds to the value $\Delta\alpha_c$. Fig. 6 shows the character of the dependence of the spin supercurrent $(I_{SS})_z$ between two virtual photons on a hypothetical difference in their precession angles $\Delta\varphi$. The difference $\Delta\varphi$ is determined by expression $\Delta\omega t$, where $\Delta\omega$ is the difference between frequencies of precession of spins of interacting virtual photons and *t* is time. Up to the value of $\Delta\varphi$ equal to $\Delta\alpha_c$, the hypothetical difference in the precession angles is equal to the difference in precession angles $\Delta\alpha$ ($\Delta\varphi = \Delta\alpha$) determining the spin supercurrent according to Eq. (10). We assume that at *t*=0 $\Delta\alpha = 0$.

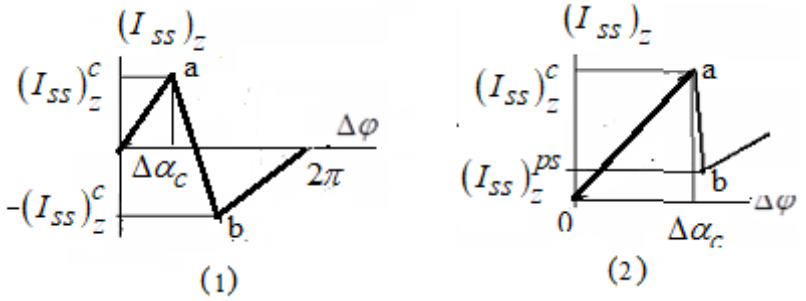



**Fig. 6.** The variants ((1) and (2)) of the dependence of spin supercurrent $(I_{SS})_z$ between two virtual photons on the hypothetical difference in their precession angles $\Delta\varphi$. $(I_{SS})_z^c$ – critical value of spin supercurrent. $\Delta\alpha_c$ – the difference of phase at which "phase slippage" takes place. Line *a*-*b* corresponds to the change in spin supercurrent in the process of "phase slippage", $(I_{SS})_z^{ps}$ – residual current.

Note. The phenomenon "phase slippage" might be explained by the theory of A. Sakharov about "Quantum vacuum elasticity" (1967) [22].

Based on the above-mentioned dependence $(I_{ss})_z$ on a hypothetical difference of precession angles $\Delta\varphi$ (Fig. 6), the dependence $(I_{ss})_z$ on $\Delta\varphi$ in arbitrary range (Fig.7) is considered.

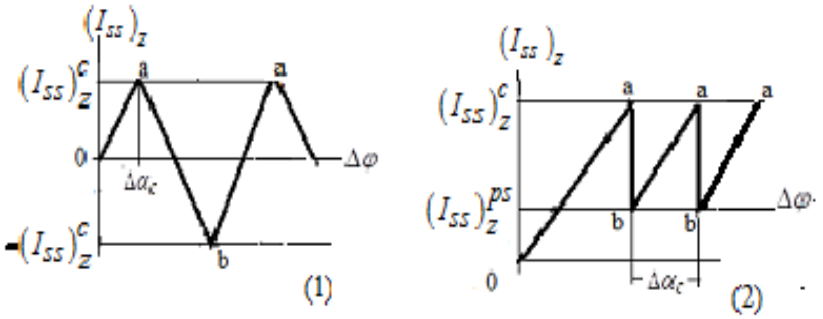



**Fig. 7**. The variants ((1) and (2)) of the dependence of spin supercurrent $(I_{ss})_z$ between two virtual photons on a hypothetical difference in their precession angles in arbitrary range $\Delta\varphi$. $(I_{ss})_z^{ps}$ – residual current, $\Delta\alpha_c$ – the difference of phase at which "phase slippage" takes place. $(I_{ss})_z^c$ is critical value of spin supercurrent.

**(3) Additional information.**

Eq. (10) defining spin supercurrent (through the potential difference) is comparable with the equation defining electric current:

$$\mathbf{I}_e = \varphi_2 - \varphi_1, \tag{11}$$

where $\varphi_1$ and $\varphi_2$ are electric potentials, and with the equation defining gravitational interaction:

$$\mathbf{G} = \phi_2 - \phi_1, \tag{12}$$

where $\phi_1$ and $\phi_2$ are gravitational potentials.

As follows from Eqs. (10) - (12), definition of spin supercurrent, electric current and gravitational interaction does not contain mass and, consequently, they are free from dissipative processes related to kinetic energy. That is, they are inertia free processes. Consequently, the speed of these processes $y$ may be greater than the speed of light:

$$y > c. \tag{13}$$

*Note.* There is no contradiction with Special Relativity since the Special Relativity postulates the speed limit only for an inertial process [23].

## III. Types of Pyramids

Let us consider the following types of pyramids: a pyramid with a rectangular base, a round pyramid with a nonrectangular base, and so-called a "mummifying" battery which is a stack of hemispheres arranged coaxially.

**(1)** The investigation showed that pyramids with a rectangular base (for example, the highest pyramids of the Giza ensemble: Cheops, Khafre, and Menkaure (Figure 1) are by far the most studied cavity structures. The degree of the effect of a cavity structure with a rectangular base is maximum if its opposite sides are oriented along the Earth's magnetic field (see Figure 8):

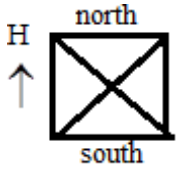
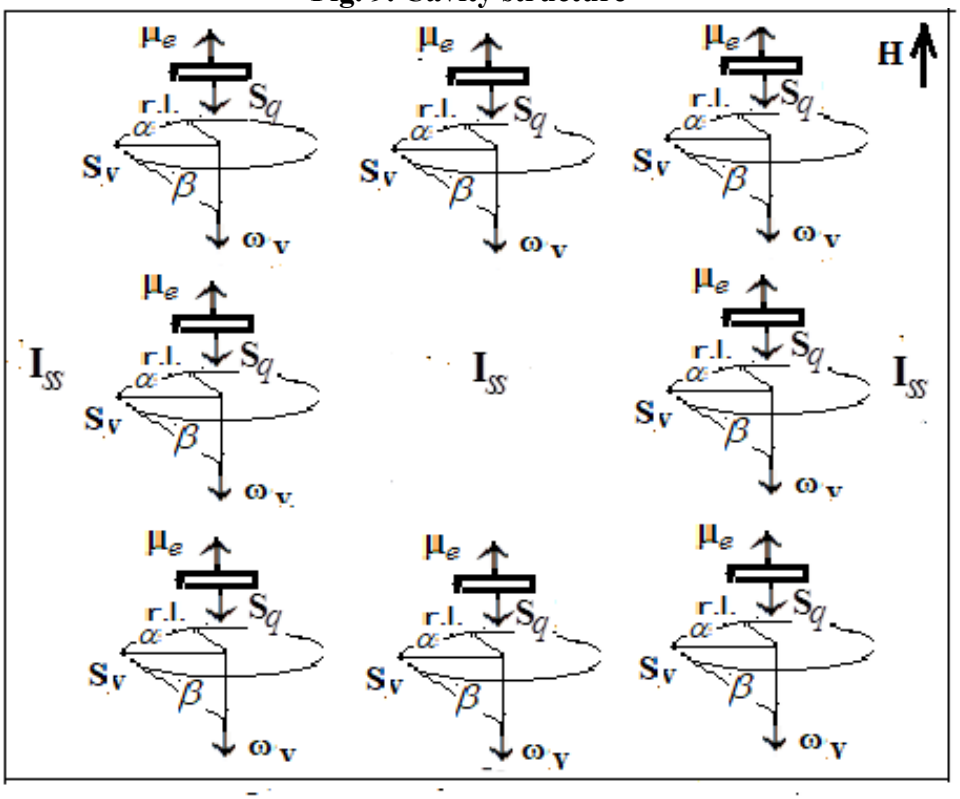



**Fig. 8**. The diagram of a pyramid with a rectangular base. H is the Earth's magnetic field strength. The opposite sides of the pyramid are oriented in the direction south-north.

In Figure 9, a diagram of a pyramid with a rectangular base and with an indication of virtual photons created by quantum objects constituting the pyramid is given**.** The magnetic dipole moments $\boldsymbol{\mu}$ of quantum objects are oriented along **H.** Consequently, spins $\mathbf{S}_q$ of these quantum objects and, according to Eq. (5), frequencies $\boldsymbol{\omega}_\nu$ of precession of spins $\mathbf{S}_\nu$ of virtual photons created by these quantum objects require uniform orientation; this means that between these virtual photons the emergence of spin supercurrent is possible (see equation (10)).

*Note*. In the diagram shown in Figure 9, it is assumed that quantum objects are electrons.

**Fig. 9. Cavity structure**




**(2)** Let us consider the case where a cavity structure does not have a rectangular form (see Fig. 10). For example, it may be a round pyramid Guachimontones (see Fig. 1) with a nonrectangular base.

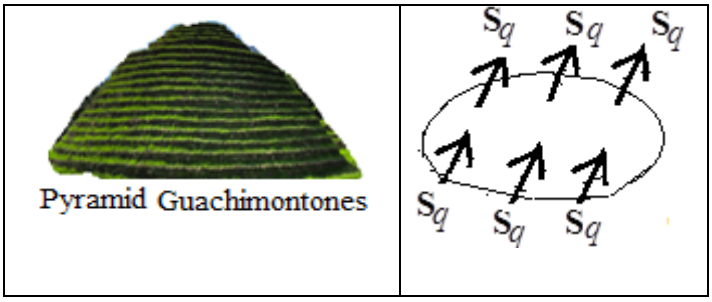



**Fig. 10.** $\mathbf{S}_q$ - spins of quantum objects constituting the base of a round pyramid (Figure 1). Orientation of $\mathbf{S}_q$ is a consequence of a spin-orbital interaction of quantum objects.

**(3)** Let us consider "stack emitters" [24]. A "trace" created in physical vacuum by a stack emitter after its removal remains active for several more days.
Let us consider the physical features of substance that makes up the hemispheres.

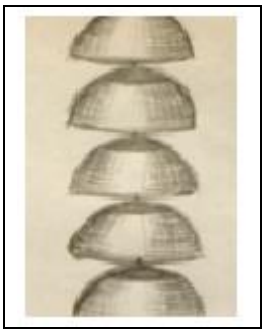


**Fig. 11**. A stack emitter made of hemispheres. If it is a 9 cm diameter "battery" consisting of nine hemispheres, then a power output is 4 watts.

It is made of anisotropic wood, that is a substance having "polarity". In this substance, quantum objects with uniformly oriented spins may exist.

## IV. Experimental Data

**(1)** Experiments by J. Parr with pyramids (1977-1997) discovered the creation by a pyramid of the shielding area called by Parr a "bubble" [25]. The action of a source of radioactivity, electromagnetic and magnetic fields, placed into a pyramid, is shielded by a "bubble". Besides, there are some works showing that bodies may lose weight in this area [4].

*Explanation.* According to Maxwell's theory, the processes of transformation of angular momentum and gravitational interaction (see Eqs. (10) and (12)) may have common physical properties [17]. Therefore, the bodies placed in the area of action of spin supercurrent may change the weight.

**(2)** The value of electric resistance of a graphite plate placed in a pyramid changed during the day according to a sinusoidal law [24].

*Explanation.* As shown in Fig. 7, spin supercurrent acting on a graphite plate, may be alternating due to the existence of "phase slippage" between the interacting virtual photons (see Fig. 6).

**(3)** Oskar Korschelt and Victor Grebennikov observed a faint glow of the cavity structure in the dark [4].

*Explanation*. According to Eq. (8), at the speed of a quantum object equal to the speed of light, the virtual photon created by a quantum object converts into emitted photon.

**(4)** In 1952, Czech researcher K. Drbal discovered the possibility of a pyramid "maintaining razor blades and straight razors sharp" without an auxiliary source of energy. He was granted a patent for this discovery [26].

*Explanation.* This phenomenon may be caused by energy generated by the spin system of physical vacuum.

**(5)** The influence of magnetic field on the degree of the effect of a cavity structure [24].

*Explanation.* The possibility of the influence of magnetic field on a cavity structure follows from Eq. (9) which determines the frequencies of precession of the spins of quantum objects. Besides, magnetic field, due to its action on the spin magnetic moment of a quantum object, influences the orientation of the spin of a quantum object.

**(6)** V. Grebennikov discovered that empty honeycombs are surrounded by a system of invisible walls; they were detected by human hands as areas with high air density [4] (Fig.12).

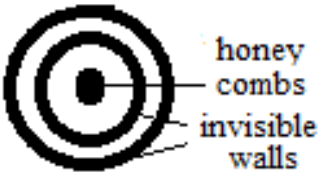



**Fig. 12**. The empty honeycombs are surrounded by a system of invisible walls.

*Explanation*. The existence of a repeating configuration is due to the following phenomena: 1) the spin supercurrent causes the compression of the medium where this current is spreading; 2) the speed of spin supercurrent is greater than the speed of spreading of compression in the medium.

**(7)** Experiments by V. Grebennikov [4] showed that spin supercurrent is not shielded by either electromagnetic or molecular shields (for example, by brick walls). However, the scattering of spin supercurrent on small randomly oriented crystals is possible; in particular, on sand that has been sifted through a very fine sieve [24].

**(8)** A delay was detected at the beginning of the cavity structure's operation and an aftereffect after the removal of the cavity structure [4].
The aftereffect of a cavity structure for a few hours and even days after the removal of a cavity structure indicates that the action of the cavity structure is being implemented by radiation that changes properties of the physical vacuum. This assumption does not contradict the properties of physical vacuum considered in Section 1.

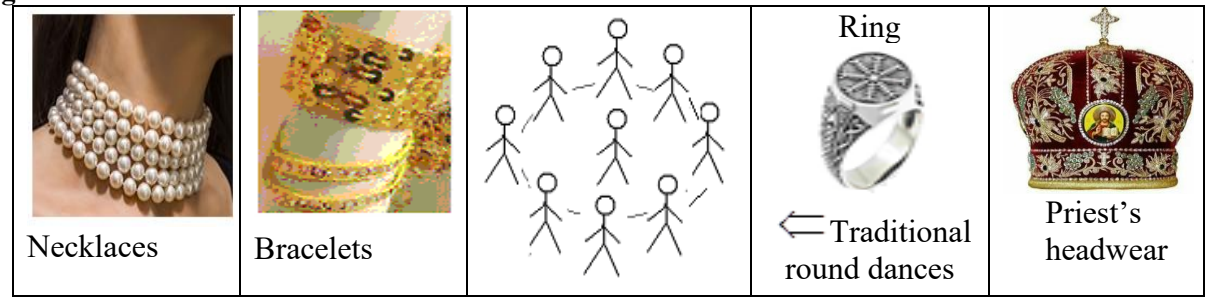
Besides, a delay at the beginning of the cavity structure's operation and an aftereffect after the removal of the cavity structure indicate the inertial properties [5] of the cavity structure, which is in accordance with a precessing motion of spins of virtual photons determining the properties of cavity structures.

## V. The effect of cavity structures on biological systems

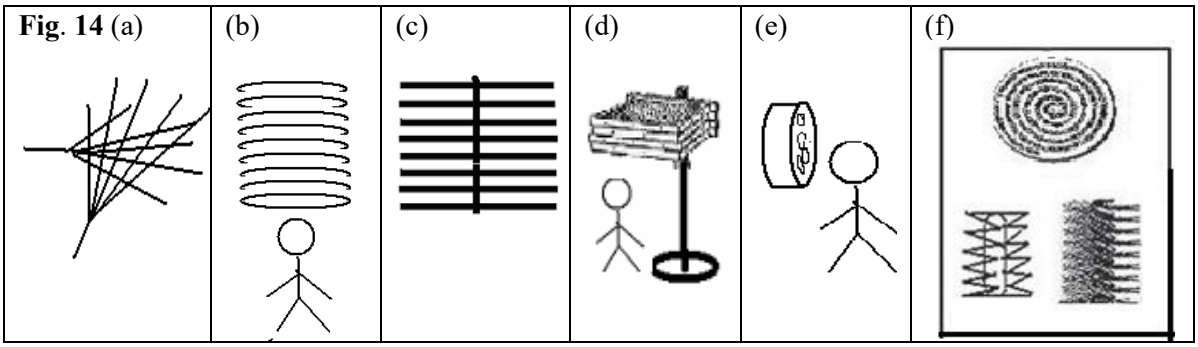
Cavity structures influence biological systems independently of the substance of a cavity structure. However, the degree of its effect depends on the substance of the cavity structure and its form (sphere, pyramid and so on).

It is possible that necklaces, bracelets, rings and traditional round dances were originally used with curative purposes, and it was only with time that they became ornaments or entertainment. A priest's headwear can also be classified as a cavity structure (Fig. 13).

**Fig. 13**.




Examples of cavity structures used medicinally are given in Figure 14.




(a) Known since the ancient times as the treatment "laying of hands" on a problem area of the body may be done by crossing one's fingers, thus forming a grate.

(b) People living on the banks of the Lower Amur used to cure a sick child by placing on a child a hoop consisting of nine wooden rings so that the child was inside the hoop [27].

(c) Chinese physicians fighting against the plague epidemic in Manchuria in 1910–1911 wore face masks that were, in fact, sets of cavity structures; it was believed that this form of mask considerably reduced the risk of infection.

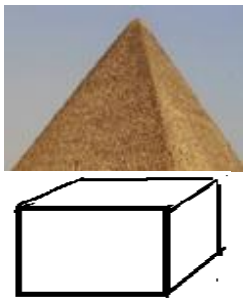
(d) The medical aspect of a cavity structure using honeycombs was studied by a Russian scientist V. Grebennikov [4].

(e) For centuries in Russia headaches have been treated by a sieve (a cylinder with a mesh bottom). The sieve was placed on the head or held in front of the face with the mesh parallel to the face.

(f) In Europe, O. Korschelt (1853–1940) was likely the first person to be granted a patent for specially fabricated cavity structures to be used for medical purposes [28]. Fig. 14(f) shows examples of the cavity structures made by Korschelt: firstly, a tin-plate cylinder with soldered zinc or steel teeth; and, secondly, the cavity structures attached to a ceiling or floor.

(g) Influence of cavity structures on animals demonstrated by Fig. 15. Comparison of weight and age of rabbits contained in pyramidal (red line) and rectangular cages (black line). The figure demonstrates results of the experiment (carried out in the USA) on the raising of rabbits in two types of cages: pyramidal and rectangular. It was shown that the weight of the rabbits raised in a pyramidal cage was 35% more than of the rabbits raised in a rectangular cage. Also, the longevity of the rabbits in a pyramidal cage was almost twice longer than of the rabbits raised in a rectangular cage.

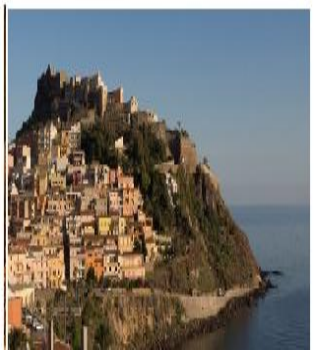
**Fig. 15.**



Pyramidal and rectangular rabbit cages [29]


**The influence of terrain relief on the population longevity.** Let us consider energy properties of some types of the Earth's landscape. In the landscape shown in Figure 16(a), the space between mountains (the Caucasus Mountains) is actually a cavity structure, thus, people living between mountains or on mountain slopes and people living in plain-like areas must have different characters and diseases. Michel Poulain and Giovanni Pes in the early 21st century identified the so-called "blue zones" in which there is the greatest number of long-livers (age greater than 90) [30]. "Blue Zones" have been identified around the world as mountainous regions, such as in Sardinia in Italy (Figure 16(b)) or Ikaria in Greece (Figure 16(c)). At the same time, the zones in which the average life expectancy has the minimum value in the world (~25 years less than in "Blue Zones"), for example, the Republic of Côte d'Ivoire (Figure 16(d)), has plain land.

**Fig. 16.** (a) (b) (c) (d)

| | | | |
|---|---|---|---|
|  |  |  |  |
| The Caucasus Mountains | Region of Sardinia in Italy | Ikaria in Greece | Republic of Côte d'Ivoire |

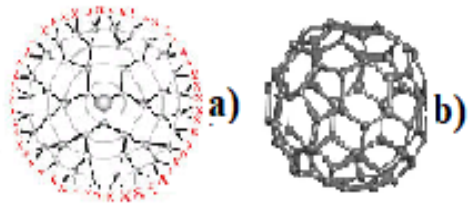
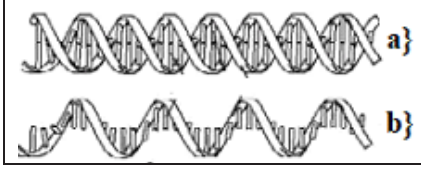
## VI. The interaction of cavity structures

### (1) The action of nanoparticles on DNA [31].

The interaction of cavity structures is the most effective when they have similar forms. It is proved experimentally that 3D NP, having spiral shape, deforms and even develops a spiral when it penetrates the DNA molecule.

For example, dendrimers 3D and higher generation influence DNA and RNA when their shape is similar to spherical. Another example is fullerenes. Computer simulations have shown that fullerenes, namely spherical C60 molecules, are potentially dangerous for the DNA of the molecule.

A schematic representation of the molecules is given on **Fig. 17.**

| | |
|---|---|
|   | Fig. 17. Metal nanoparticles. a) a molecule of a dendrimer; b) a molecule of a fullerene. |
|   | (a) DNA molecule (deoxyribonucleic acid) (b) RNA molecule (ribonucleic acid) |

**(2) Mimicry of the form**

**Fig. 18.**

| | | | |
|---|---|---|---|
|  | *Tetraponera ophthalmica* (Ant) and *Myrmarachne ichneumon* (mimicking jumping spiders) (naurok.com.ua). |  | Phelsuma serraticauda (Flat-tailed Madagascar geckos) on a Madagascar's plant. (http://photoshtab.ru). |

## VII. Applying

According to Eq. (9), the frequency $\boldsymbol{\omega}_V$ of precession of spin $\mathbf{S}_V$ of a virtual photon created by quantum objects, is proportional to the external rotation frequency $\boldsymbol{\Omega}_q$ of the quantum object and to the square of its speed *u.* The validity of equation (9) is confirmed by experiments.

**(1)** According to the experimental data [32], the rotation of a cavity structure influences its energy properties; and the form of a rotating cavity structure influences characteristics of this rotation.

**(2)**. The study by Scoryatin M. V. (alias "ENEL") showed that radiation analogous to radiation of a cavity structure, in spite of its nonelectromagnetic character, accompanies electric current [33]. A diagram of the electric current generated by negatively charged quantum objects creating virtual photons with spins $\mathbf{S}_V$ is given in Fig. 19. Frequency $\boldsymbol{\omega}_V$ of precession of spin $\mathbf{S}_V$, in accordance with Eq. (9), may be determined by the following expression: $\boldsymbol{\omega}_V = \left( m_q u^2 / 2 + \mu_q \mathbf{H} + k\boldsymbol{\Omega}_q \right) / \hbar$

In the absence of magnetic field (**H=0)** and external rotation ($\boldsymbol{\Omega}_q = 0$), the frequency $\boldsymbol{\omega}_v$ may be expressed through charge density (q) of moving quantum objects and electric current **I** created by these objects: $\omega_v = m_q I^2 / \left(2q^2\hbar\right)$.

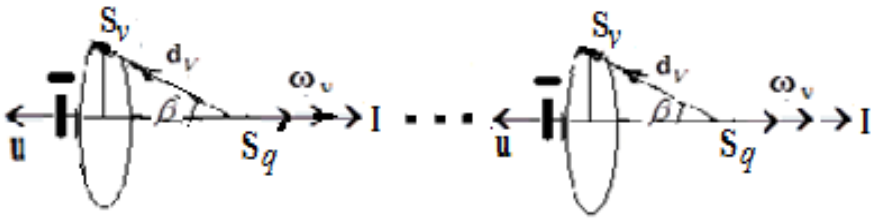



**Fig. 19.** Virtual photons created by negatively charged quantum objects having spin $\mathbf{S}_q$ and velocity **u**. $\boldsymbol{\omega}_v$ - the frequency of precession of spin $\mathbf{S}_v$ of a virtual photon, **I** – electric current.

## Conclusion

**(1)** Energy properties of cavity structures are being implemented by the action of spin supercurrent.
**(2)** The spin supercurrent arises between spins of virtual photons (spin vortices) created by quantum objects constituting a cavity structure (the concept of virtual photons was developed by a Nobel Prize Winner R. Feynman in 1949).
**(3)** The residual effect of a cavity structure, that is conservation of its properties after removing it from any area of the physical vacuum for several hours or even days, is explained by the properties of physical vacuum. Physical vacuum is characterized by internal angular momentum: by existence of quantum oscillators having precessing spin; spin supercurrent may arise between their spins. The emerging inertial processes can increase the duration of this process.

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