Chapter 5

The Spin Supercurrent as “Strange” Radiation in Low-Energy Nuclear Reactions. The Action of “Strange” Radiation on Biological Systems

Traditionally, the history of research of cool nuclear fusion, or more precisely, of Low-Energy Nuclear Reactions (LENR) starts from the experiments by M. Fleischmann and S. Pons. In March 1989 they demonstrated a device, which in the process of electrolysis of deuterium-dioxide, with the use of palladium cathode, released the energy exceeding several times the input energy and, besides, emitted neutrons [55]. It was taken to be doubtless for a long time that such processes were possible only under very high temperatures (million and billion degrees), since the fusion of nuclei in these processes was prevented by that their charges had the same sign.

The technique of experiments on cold nuclear fusion, which became already conventional, consists in saturation by hydrogen (deuterium) of substances capable to actively occlude such a gas. For example, nickel in interaction with hydrogen converts into copper, ferrum, cobalt, and zinc. To this end, besides mere holding in hydrogen atmosphere, the use is made of electrolysis or electric gas discharge [56,57,58].

The results from the studies of electrical explosions of foils made from super-pure materials in water pointed to the emergence of new chemical elements. An additional finding was the emission of a “strange” radiation accompanying transformation of chemical elements. Some researchers made the following conclusion: “Perhaps the LENR, and the “strange” radiation are two sides of the same coin and their explanation will occur simultaneously” [59,60].

Let us prove the legitimacy of this supposition and show that it is spin supercurrent that, first, takes part in emergence of LENR, and, secondly, can be a “strange” radiation [61].

5.1. Comparison of the Properties of “Strange” Radiation with the Properties of Spin Supercurrent

A system of chemical elements contains quantum objects: protons, neutrons, and electrons. According to the postulates of quantum mechanics, these quantum objects produce virtual photons in the physical vacuum. The characteristics (frequency of precession, angle of deflection) of spins of virtual photons is determined by the energy of quantum objects creating these virtual photons. Consequently, a change in the energy of quantum objects (for example, at heating, electrolysis or in electric gas discharge) results in a change in the characteristics of virtual photons created by these objects. Then, according to Eq. (1.12), spin supercurrent arises between virtual photons, and at arbitrary time *t*, according to Eqs (1.6), (1.8), (1.16) and (1.17), it is determined to be:

$$\begin{aligned}(I_{ssz})^t &= -tb_1(U_2 - U_1)/\hbar \\ &-b_2\left(\arcsin\sqrt{2U_2/\left(m_2c^2\right)} - \arcsin\sqrt{2U_1/\left(m_1c^2\right)}\right),\end{aligned} \qquad (5.1)$$

where U_1 and U_2 are kinetic energies of interacting quantum objects; m_1 and m_2 are masses of the quantum objects.

Let us compare the properties of “strange” radiation with the properties of spin supercurrent in detail.

1) According to Eqs (1.14)-(1.15), spin supercurrent equalizes the characteristics of spins of virtual photons between which it emerges. Consequently, a situation is possible when the spins (respectively $\mathbf{S}_1$ and $\mathbf{S}_2$) of these virtual photons (see Figure 5.1) will be oriented in one direction:

$$\mathbf{S}_1 \rightarrow\rightarrow \mathbf{S}_2 . \qquad (5.2)$$

According to Eq. (1.7), the similar holds for electric dipole moments (respectively $\mathbf{d}_1$ and $\mathbf{d}_2$) of the virtual photons:

$$\mathbf{d}_1 \rightarrow\rightarrow \mathbf{d}_2 . \qquad (5.3)$$

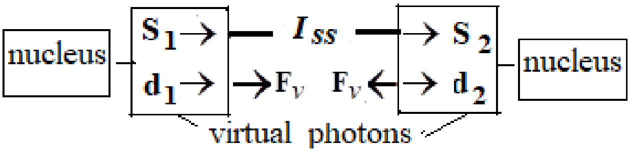

Figure 5.1. The schema of forces acting between nuclei in the nuclear reaction. $\mathbf{F}_V$ is an attractive force between virtual photons (consequently, between nuclei creating these virtual photons). $\mathbf{S}_1$ and $\mathbf{S}_2$ are spins of virtual photons; $\mathbf{d}_1$ and $\mathbf{d}_2$ are electric dipole moments of the virtual photons; I_{ss} is spin supercurrent.

In this case, an electric dipole-dipole attractive force $\mathbf{F}_V$ emerges between these virtual photons [62]. The attractive force $\mathbf{F}_V$ can be the force emerging between the virtual photons created by nuclei participating in the nuclear reaction, see Figure 5.1. It should be noted that LENR is accomplished due to attractive forces emerging between like charged nuclei of different atoms [63].

Thus, spin supercurrent (under the name “strange radiation”) does not only accompanies LENR but it can initiate this process as the action of spin supercurrent can result in the emergence of attractive forces between like charged nuclei of different atoms.

2) A spin supercurrent does not arise between quantum objects creating virtual photons having total zero spin (for example, between Cooper pairs, as the virtual photons created by quantum objects constituting the pair have total zero spin). The most probable is the emergence of a spin supercurrent in the substances that have “free” quantum objects, such as in metals containing “free” electrons.

It is in accordance with the properties of chemical elements involved in LENR: the elements used in these reactions, i.e. nickel, lithium, palladium are metals; hydrogen has one electron [57,63].

3) It follows from expression (1.12) that spin supercurrent is not spreading between virtual photons with equal precession angles ($\Delta\alpha = 0$) and equal deflection angles ($\Delta\beta = 0$), that is between virtual photons with uniformly oriented spin (see Figure 1.1). Thus, under the fulfillment of Condition (1.10) spin supercurrent is not spreading in a spin-polarized medium, for example, in a magnetized medium.

The “strange” radiation accompanying LENR is characterized by this property: it is not spreading in a magnetized medium [57,63].

4) The spin supercurrent is neither an electric nor a magnetic process.

It is an experimental fact that “strange” radiation is neither a magnetic nor an electric process [59,60].

5) Spin supercurrent is capable to magnetize nonmagnetic materials, since according to Eq. (1.12) it influences the characteristics of spins of virtual photons, and thus, according to Eq. (1.10), the spins $\mathbf{S}_q$ of quantum objects producing these virtual photons. The spin of a quantum object, in turn, is associated with its magnetic moment [62].

The magnetization of nonmagnetic substances by “strange” radiation was observed in many experiments [63].

6) According to Eqs (1.14)-(1.15) and (1.18), spin supercurrent changes the characteristics of spins $\mathbf{S}_V$ of virtual photons between which it emerges, which results in $\partial \mathbf{S}_V / \partial t \neq 0$ in these virtual photons and, according to Eq. (1.5), in $\partial \mathbf{E}_V / \partial t \neq 0$. According to Maxwell's equations, the latter inequality can initiate the emergence of electromagnetic oscillations. Thus, spin supercurrent can be accompanied by appearance of electromagnetic oscillations.

It has been experimentally detected that "strange" radiation is accompanied by electromagnetic oscillations [59].

7) According to the properties of spin supercurrent, Eq. (1.13), the speed of spin supercurrent is greater than the speed of light. More precise, the value of speed of spin supercurrent can be obtained in studies of quantum correlations; it has been shown by L. Boldyreva [9,10] that quantum correlations are accomplished by spin supercurrent. Experiments exist [64] in which it is shown that the speed of quantum correlations is greater by factor of 10^4 than the speed of light.

The experiments conducted show that the "strange" radiation accompanying cold nuclear fusion can have the speed exceeding the speed of light (by possible factor of $\sim 10^3$).

8) By definition, spin supercurrent transfers angular momentum (angles of precession and deflection), consequently the emerging tracks on the surface of various materials can have a vortex form.

According to experimental observations, the tracks created by "strange" radiation can have a vortex form. The schematic image of tracks created by "strange" radiation and having a vortex form is given in Figure 5.2. [65,66].

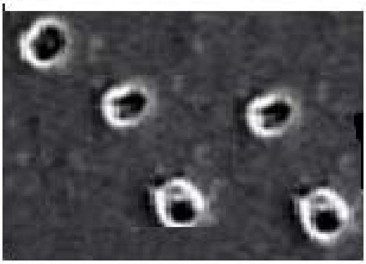

Figure 5.2. The schematic image of tracks created by "strange" radiation and having a vortex form.

9) As spin supercurrent emerges between spins $\mathbf{S}_v$ performing precession motion, the tracks created by spin supercurrent can have a spiral form.

This phenomenon is observed in tracks created by “strange” radiation accompanying LENR [65].

10) If spin supercurrent causes the contraction of the medium where it spreads and the speed of spin supercurrent is greater than the speed of spreading this contraction, then the action of spin supercurrents can result in appearance of periodically repeating jumps in density [16].

In many experiments with LENR the twin-tracks on the surface of various materials often emerge. The example of possible track’s structure is given in Figure 5.3 [67].

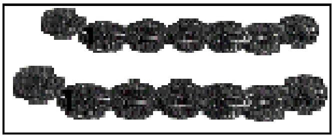

Figure 5.3. The possible structure of twin-tracks in experiments with LENR

11) According to property 6 of spin supercurrent, see Section 1.2, spin supercurrent is not shielded by electromagnetic and molecular substances. The exclusion can take place while passing spin supercurrent through the substances containing a great number of quantum objects creating virtual photons with nonzero total spin, see Eq. (1.21).

It was found experimentally that some of the phenomena accompanying cold nuclear fusion (the emergence of optical radiation and abnormally high heat emission) were observed as well in the areas adjacent to active zones of the reactor where the experiments were conducted. The exclusions are the cases of using a multi-layered aluminum foil for screening (that is of using metal substance having a great number of free electrons creating a great number of virtual photons) [57,65].

12) The characteristics of virtual photon’s spin (angles of deflection and precession, frequency of precession) are determined by the velocity (value, direction) and energy of the quantum object creating the virtual photon, Eqs (1.6), (1.8) and (1.16)-(1.17). Thus, the action of spin supercurrent, while equalizing the values of the characteristics of virtual photons’ spins equalizes as well the energy characteristics (see also Eq. [5.1]) of quantum objects

creating these virtual photons. Consequently, the action of spin supercurrent suppresses the chaotic motion of quantum objects, which can result in a decrease in the temperature of substance consisting of the quantum objects.

It was found experimentally that in the process of cold nuclear fusion there were observed areas with reduced temperature.

Usually, reactors using external heating are characterized by the temperature higher than environment's temperature. However, in some cases, calorimeters show that the quantity of heat emitted is less than the respective quantity of electric energy consumed, which can tell of the existence of a process decreasing the temperature in the reactor [63,65].

13) As the orientation of virtual photon's spin is associated with the orientation of spin $\mathbf{S}_q$ of quantum object creating this virtual photon, see Eq. (1.10), the external magnetic field imposed on the quantum objects influences not only the orientation of their spins but orientation of spins of virtual photons created by these objects as well. The change in the orientation of virtual photons' spins (that is, in the values of their precession angles or/and of deflection angles), in accordance with Eq. (1.12), changes the spin supercurrent existing between the virtual photons.

According to experimental data, the use of external magnetic field influences the characteristics of LENR [65].

14) As virtual photons have a precessing spin (Figure 1.1), the virtual photons the gyroscopic stability [16]. Therefore, the recovery of initial values of precession's angles, of deflection's angles and, consequently, of the value of spin supercurrent between interacting virtual photons takes place with a time delay.

The aftereffect of "strange" radiation emerging after the termination of nuclear reaction, has been discovered experimentally [65]. One of the experiments was as follows: after the explosion of the foil in water this water and leftover foil were placed in a petri dish and a photographic film was placed at the distance of 10 cm from them. After the 18-hour exposition the same tracks were found on the film as those after the electric explosion.

15) If the precession frequencies of interacting virtual photons' spins cannot be oriented along one direction (for example, it takes place in cavity structures, see Chapter 9), then spin supercurrent between the virtual photons exists constantly.

A similar situation can take place in the atomic reactor if the configuration of the reactor is like a cavity structure (there is a curvature) spin supercurrent can exist in the reactor for any time. This accounts for the results of the studies where “strange” radiation is observed during several years after the termination of nuclear reactions. The intensity of radiation of reactor segments was weakening in time, however, in several years the radiation was observed [68].

Note. It cannot be excluded that the spin supercurrent can be part of background radiation observed experimentally in nuclear reactors as well [65].

16) The virtual photons consisting of two unlike charged virtual particles (according to the hypothesis by Feynman) can be destroyed in the electric field of nucleus (or during electric gas discharge) into charged virtual particles having spin $\mathbf{S}_v / 2$. If spin supercurrent orients these spins in one direction, then according to Eq. (1.22) an attractive pseudomagnetic force acts between like charged virtual particles producing complexes analogous to ball lightning (in detail see [10]). The charged complex is of nonmagnetic nature, but it can magnetize other bodies due to the action of spin supercurrent between complex’s spins and spins of virtual photons created by quantum objects of other bodies. That is, a charged complex can show the magnetic properties, not being a magnetic object.

If the mutual orientation of spins of like charged virtual particles constituting the ball lightning changes, then the attractive force between these virtual particles converts into a repulsive force between them, see Eq. (1.22).

During the performance of LENR an analogue of ball lightning can emerge [67,69], see Figure 5.4. It can magnetize other bodies.

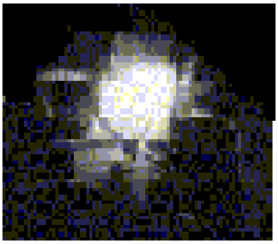

Figure 5.4. The type of ball lightning emerging during LENR (the size: several cm).

Later the ball lightning can discharge on high voltage wires or crumble into many small balls (that is the explosion of ball lightning takes place) [69].

17) The spin supercurrent can influence BS [10,23].

There are experimental proofs that “strange” radiation influences BS [66,70].

5.2. The Action of “Strange” Radiation on Biological Systems

Let us consider the examples of action of “strange” radiation on BS.

Pilot studies were performed at the RECOM RRC “Kurchatov Institute” (Russia) in April–May of 2004 [70].

Animals used in the experiment were female mice of C57Bl/6 line aged 80 days with body weight 16–18 g. The cages with animals were placed at 1m from the explosion epicenter. Every cage was occupied by 20 mice of the control group or 17-20 mice of one of the experimental groups. The investigations were conducted in the following directions.

1) The estimation of the key hematological parameters (in particular, the number (*n*) of nucleated cells in the bone marrow).

2) Analyses of the Peripheral Blood Cell Composition.

1) The estimation of the key hematological parameter: the number (*n*) of nucleated cells in the bone marrow.

The “strange” radiation discharged during explosions of Ti foils in water and aqueous solutions. The animals were assigned to 4 groups (control and three experimental), each of 17-20 mice. The first experimental group was exposed to 3 explosions within the 1st day. The second experimental group was exposed to 3 explosions within the 1st day and 4 explosions within the 2nd day. The third experimental group was exposed to 3 explosions within the 1st day, 4 explosions within the 2nd day and 3 explosions within the 3d day.

The normalized number n_r of nucleated cells in the bone marrow of mice was measured and found as increasing with increase of total number of explosions. The normalized number n_r is determined as follows: $n_r = n / n_c$, where n is number of nucleated cells at arbitrary total number of explosions, n_c is number of nucleated cells at zero total number of explosions. Results are shown in Figure 5.5.

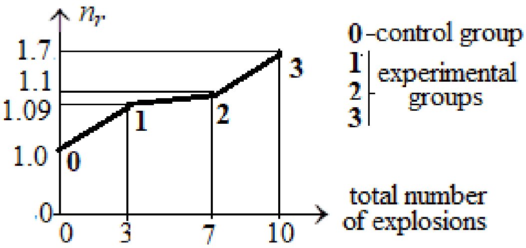

Figure 5.5. The dependence of the normalized number (n_r) of nucleated cells in the bone marrow on the total number of explosions while animals were placed at 1m from the explosion epicenter.

2) Analyses of the peripheral blood cell composition.

The rates of peripheral blood neutrophils were observed in the conducted experiment. The groups of animals that took part in this experiment were formed similar to the groups of animals that took part in the previous experiment.

The normalized value (k_r) of the rates of peripheral blood neutrophils is shown in Figure 5.6. The normalized value (k_r) is determined as follows: $k_r = k / k_c$, where k is the rate of neutrophils in the peripheral blood at arbitrary total number of explosions, k_c is the rate of neutrophils in the peripheral blood at zero total number of explosions.

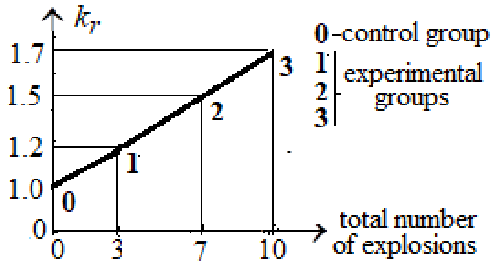

Figure 5.6. The normalized value (k_r) of the rate of neutrophils in the peripheral blood (in percentage) against the total number of explosions.

Along with the changes in the contents of neutrophils in the peripheral blood, the rate of peripheral blood *lymphocytes* was found to be reduced. A statistically significant decrease in this parameter to 68% was observed at day 3 of exposure.

3) Studies of the Genotoxic Effects of “Strange” Radiation.

To evaluate the genotoxic effect of “strange” radiation, the rate of micronuclei in the bone marrow erythrocytes was analyzed. The combined exposure to “strange” radiation and subsequent gamma-irradiation at a dose of 6 Gy are used in the experiment. The observed normalized (related to rate of control group) rate δ of micronuclei in the bone marrow erythrocytes in experimental groups of mice is shown in Figure 5.7.

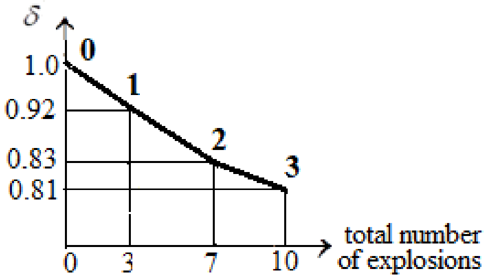

Figure 5.7. The normalized (related to rate of control group) rate δ of micronuclei in the bone marrow erythrocytes in experimental groups of mice after the combined exposure to “strange” radiation and subsequent gamma-irradiation at a dose of 6 Gy.

Thus, the “strange” radiation induces changes resulting in the increased resistance of BS to genotoxic exposures (the lethal doses of gamma-radiation of 6 Gy are used).