Introduction

One of the founders of quantum mechanics, E. Schrödinger, studying the physical aspect of functioning of a living organism developed the following conclusion [1]: “The living organism seems to be a macroscopic system which in part of its behavior approaches to that purely mechanical (as contrasted with thermodynamical) conduct to which all systems tend, as the temperature approaches absolute zero and the molecular disorder is removed.”

That behavior of a living organism is similar to behavior of systems in which the molecular disorder is removed lets us to suppose that the same physical process functions both in a living organism and in the above-mentioned systems. It follows from Schrödinger’s conclusion that the effectivity of this process depends on the disorder in the motion of quantum objects taking part in this process. Among the known physical processes: gravitational, electrical, magnetic (between uncharged objects), spin supercurrent, only the characteristics of spin supercurrent depend on the “disorder” in the motion of quantum objects between which it emerges.

Spin supercurrent is a process transferring angular momentum between spins of quantum objects. The first works introducing the process of transfer of angular momentum in descriptions of physical phenomena were works by J. C. Maxwell describing a model of luminiferous ether in 1861-1873 [2,3]. In hundred years, the investigation of the process of transfer of angular momentum was continued (with taking into account the quantum object characteristic discovered in the 20th century - spin) by M. Vuorio [4], in his experiments this process was called “long transport of spin polarization”. In the following years the process was studied in experiments with superfluid ^{3}He-B by A. Borovic-Romanov, Yu. Bunkov, V. Dmitriev, I. Fomin et al [5,6,7]; in the latter investigations the process of transfer of angular momentum is called “spin supercurrent”.

It should be noted that Bunkov, Dmitriev, and Fomin were awarded the Fritz London Memorial Prize in 2008 for the studies of spin supercurrents in superfluid ^{3}He-B.

In 1949, R. Feynman for the denotation of force fields in his diagrams introduced virtual particles created by quantum objects [8]. The properties of the virtual particles depended on the interaction in which they were involved. For example, electric and magnetic interactions are accomplished by so-called virtual photons whose characteristics are analogous to photon’s characteristics transferring electromagnetic oscillation as well.

It is shown in the works by L. Boldyreva [9,10] that the characteristics of precessing spin of virtual photon are the characteristics of the wave function of the quantum object creating the virtual photon: the frequency of precession equals the wave function frequency, the angle of precession equals the wave function phase, the size of virtual photon as an electric dipole (it consists of oppositely charged virtual particles) equals the wavelength of wave function. According to Schrödinger’s equation [1], the characteristics of wave function of quantum object depend on the velocity and energy of the latter. Consequently, spin supercurrent emerging between virtual photons will depend on their velocity and energy.

If quantum objects constituting a medium have equal energy and velocity, then it means that the medium can be described by a single wave function. With this point of view the spin supercurrent emerging at violence of the “order” in the orientation (angles of precession and deflection) of spins of virtual photons created by quantum objects of a medium can be considered as a process providing the possibility of describing the medium by a single wave function. From that it follows that theoretically the speed of spin supercurrent must be infinite. There is no contradiction with Special Relativity since spin supercurrent is *an inertia-free process* (is not accompanied by emergence of mass): Special Relativity postulates the speed limit only for an inertial process [11,12].

The action of spin supercurrent can explain many phenomena in biophysics, including those that have had no physical explanation as yet, in particular, the effective action on biological systems of biologically active substances in ultra-low dozes, nanoparticles, magnetic vector potential, “strange” radiation accompanying nuclear reactions, cavity structures.

Note. The following abbreviation is used in this book:

BS—Biological Syste