

Biophysical Approach to Psi Phenomena

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ABSTRACT

The problems and possibilities of modern parapsychology are discussed from the viewpoint of the natural sciences, focusing on the research senses. First, the author points out that more consideration of parapsychological phenomena should be made from the viewpoint of biophysics. Next, through experiments on healing (bio-PK) by the author or the author and co-workers, the claim is made that the magnitude of the power of psi (also known as ki or qi) can be described as the J value which is the natural logarithm of the ratio of physical quantities. Moreover, through discussion on a wave-like potential distribution of bio-PK around the human body, the possibility of plural unknown factors related to psi phenomena is indicated and those factors follow their own physical laws.

Key Words: parapsychology, consciousness, J value, wave-like potential, bio-PK, non-contact healing, psi, *Cucumis sativus* 'white spine type' cucumber, bio-sensor

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1. Modern Parapsychology and Modern Physics

Parapsychology is the research field focused on paranormal phenomena which relate to human potential abilities. Parapsychology can be said to include scientific studies on extrasensory perception (ESP), psychokinesis (PK) and survival problems; and psi is used as a general term for ESP, PK and other paranormal processes and paranormal causation.

Parapsychology is an interdisciplinary domain. Therefore, researchers can deal with parapsychological phenomena from various academic viewpoints, for example, cultural, religious and sociological aspects, psychological and philosophical aspects, and biological and biochemical aspects. Also researchers can deal with them as unrevealed physical phenomena.

Many researchers consider that psi has very strange properties (see for example, Kasahara, 1993). For instance;

- (1) ESP can be detected even if the distance between a participant and a target is several hundred kilometers. Distance effects are very weak in psi phenomena.
- (2) Psi not only does not experience spatial restrictions, it does not have time restrictions either. Psi can interact with future events at least several seconds or more before the present time.
- (3) In both cases of an easy task and complicated task, psi can be detected similarly. Psi seems to be goal-oriented.
- (4) No substance which interrupts psi has been found yet.
- (5) The psi phenomenon becomes hidden and elusive if an attempt is made to observe it carefully.

Because of the strange behaviors of psi apparently associated with quantum phenomena, some researchers, such as Jung and Pauli (1976), thought that human consciousness or the mind was essentially a quantum mechanical phenomenon.

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Parapsychologists have discussed the relationship between psi and the problem of observation in quantum theory since the 1970s (for example, Walker, 1974; Schmidt, 1984; 1985; Millar, 1988), and those discussions are referred to as observational theory in parapsychology.

The quantum mechanical interpretation of psi phenomena is well suited to driving research studies. However, a firm belief is lacking that the phenomenon of consciousness is linked with quantum physics directly. Here, the author tries to discuss the relationship between modern parapsychology and physics, especially through examples from biophysical studies of the author or the author and co-workers.

2. Life Phenomena, Bio-sensor & Healing

When the author has discussed observational theory in parapsychology with his collaborators, he has often found that it was implicitly assumed that psi phenomena could be explained by physics and psychology. However, this implicit assumption cannot be correct.

Human beings are animals which have bodies. If researchers want to understand humans, they should understand the human body too. It is obvious that the consciousness or mind is limited by corporal restrictions, at least as long as person is alive, although there is a possibility that consciousness can exist without the body. Table 1 summarizes the conceptual layered structure assumed in this paper. The consciousness is a mysterious phenomenon but it can be said that the mystery of consciousness originates from the mystery of life.

Table 1. Conceptual layered structure.		
Layers	Phenomena	Related Sciences
Mind	Consciousness phenomena	Parapsychology, religious study, cultural anthropology, sociology, psychology, etc.
Body	Life phenomena	Medical sciences, biology, physiology, biochemistry, biophysics, etc.
Universe	Physical phenomena	Physics, chemistry, etc.

Life phenomena are important factors when parapsychological phenomena are discussed. This has been clearly demonstrated

through experiments of cultured cells or other living bodies; if healers gave their power such as “ki” (also known as “qi”), “non-contact healing” and “bio-PK” to plants or cells, anomalous changes of the growth ratio or activity of the target organisms were detected (Grad, 1976; Yamauchi *et al.*, 1996; Kataoka *et al.*, 1997a; 1997b; Radin *et al.* 2003). Parapsychological phenomena can be detected even in cells which do not have consciousness.

Clients of healing or ki therapy often claim that they “feel power.” (In the present paper, the author uses the terms “power”, “energy” and “potential” conventionally. Physical validities of those terms should be discussed in future studies.) Two detection cases for this power can be considered: in the first, the central neuron system detects it directly; and in the second, somatic cells (or the whole body) detect it. In both cases, the psi signal is considered to be detected by cells at the first stage and then reaction processes are caused, finally the signal is recognized by humans if the final output of the reaction process is large enough. The fact that humans can recognize only large output signals means that their consciousness is not sensitive as a detecting device for parapsychological phenomena. It is well known that researchers can detect psi effects through unconscious factors of subjects, especially the change of physiological factors such as the subjects’ EEG, brain blood flow, electrodermal activity, etc even if the subjects do not themselves recognize psi signals in their mind (see for example, Radin, 1997; Yamamoto *et al.*, 2000; Bierman & Scholte, 2002; Baker & Stevens, 2008). Also, “bio-sensors” have been used in recent successful studies about such behavior as pre-sentiment (see for example, Radin, 1997). The human body is used as a kind of bio-sensor in many pre-sentiment experiments and it is generally considered that the human body is more sensitive than human consciousness in detectivity of psi.

The concept of bio-sensors also can be extended to experiments in which researchers deal with a living body as a sensor. Of course, medical researchers never deal with their patients as sensors. The concept of bio-sensors is a biophysical concept, not a medical concept.

Why are bio-sensors sensitive to *psi* or *ki*? Living bodies consist of molecules and have various organs, structures, and



biochemical systems. If a stimulus is given to a living body and a biological change is caused there, a biochemical reaction will arise continuously and amplification of the change will appear so that an immunity system may produce a countering substance, such as in fighting a virus causing a disease. Living bodies are considered as multiple sensors with an amplifying circuit, which can react to various kinds of signals although commonly, physical sensors are specialized for certain kinds of signals. Therefore bio-sensors can detect unidentified signals such as psi.

Bio-sensors can be viewed as a complicate black box and it is not easy to identify which factors are reacting to psi. However it is a fact that specific mechanisms of the living body react easily to psi. There are a number of examples. The calcium ion channels in a membrane of human neutrophils are able react toward ki (Kataoka, *et al.*, 1997a; 1997b); if a specific antibiotic is given to cultured cells, it acts as an inhibitor against effects of ki (in other words, the specific biochemical systems, which are obstructed by the inhibitor, can react toward ki) (Yamauchi *et al.*, 1996); if some drug is given to an animal, a change in its EEG occurs which is similar to the change caused by effects of ki and moreover, if an inhibitor to the drug is given, the effects of ki will not appear in the EEG (Takeshige & Aoki, 1994). Some people have a tendency to think that psi is almighty, but in fact, psi can cause only specific phenomena. The limits of psi are noteworthy objectives when studying the mechanisms of psi. Studying and using bio-sensors will certainly offer benefits in the future.

3. Experiments with Cucumber Pieces as Bio-sensors

In 2006, the author and collaborators developed a new quantitative method to measure magnitude of bio-PK (healing) power using biophotons (Kokubo, *et al.*, 2006); biophotons are ultra-weak photons which are emitted from living bodies. In the method, sample pairs consisting of target and control pieces of cucumber (*Cucumis sativus* 'white spine type' cucumber) were used as bio-sensors. A healer did non-contact healing for 30 min against the target cucumber pieces. After the healing trial, the intensities of biophotons emitted from the target and

control cucumber pieces were measured for 18 h.

After developing this method, the experimental strategy was revised. One of the revised points was the measurement time and interval. The samples were measured for a long time after healing. This idea originated from experiments with cultured cells in which healing effects can be detected after a few weeks. The design change was very successful and the estimated magnitude of a healer's power have been obtained by making only a few measurements (Kokubo & Yamamoto, 2007a; 2007b; Kokubo *et al.*, 2007; Kokubo & Yamamoto, 2009). Figure 1 shows the transition of intensities of biophotons emitted from cucumber pieces (Kokubo & Yamamoto, 2007a; Kokubo *et al.*, 2010a). This data is a summary of 14 healers (102 cucumber pieces). In this experiment, each healer tried to do healing to increase cucumber's vitality and brightness. Blue dots are data of experiment (healing) and pink dots are data of control in the upper figure. The lower figure shows a difference of biophoton intensities between healing and control. There is no difference of biophoton intensities between healing and control during the first 4 h. Significant difference occurs after 5 h. This difference can be approximated by an equation of chain reactions, and the author calls it as bio-PK response (Kokubo *et al.*, 2010a). This data shows an importance of long-term measurements. Also it suggests that photon-emission mechanisms are different between the first 4 h term and the later term, and that healing (bio-PK) affects on the later mechanisms only. This is an example that psi influences easily to specific bio-chemical reaction systems.

4. Connection between Modern Physics and Psi

The author and co-workers introduced the J value as an index of magnitude of bio-PK power (or effects) (Kokubo *et al.*, 2006). In biophoton experiments, J value is defined as Equation 1.

$$J = k \ln \frac{I_E}{I_C} \quad (1)$$

Here, I_E and I_C are biophoton intensities of experiment and control samples, \ln is the natural logarithm, and k is a coefficient. Quantitative discussions of psi become easier



if J value is used (Kokubo & Yamamoto, 2007; Kokubo *et al.*, 2007b; Kokubo & Yamamoto, 2009). J value is a standardized value of biophoton intensities. It was suggested that this standardized value was useful when making measurements with bio-sensors such as cucumber pieces. It is important to keep samples in the same conditions because J value is calculated by paired data of experiments and controls.

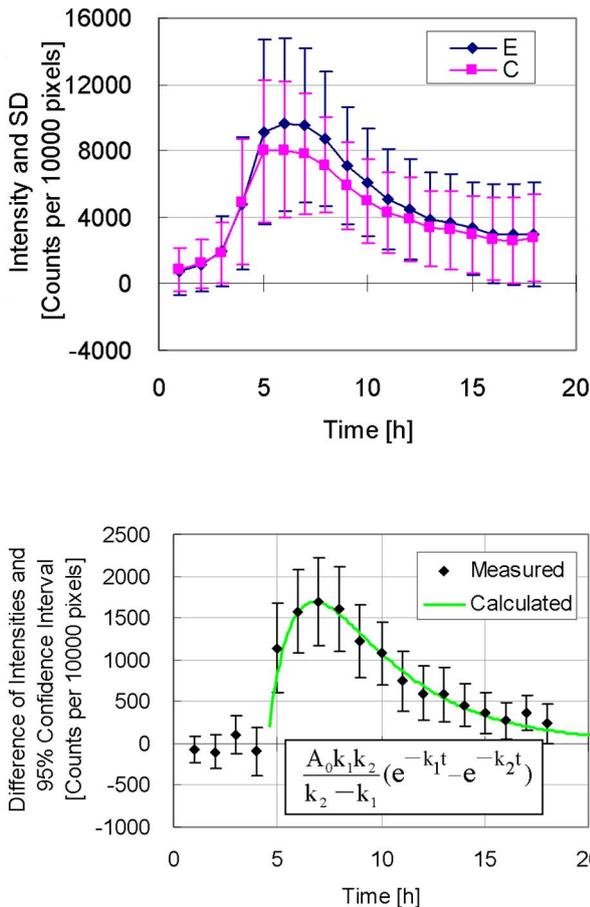


Figure 1. Upper: Transition of biophoton intensity and SD. Below: Difference of biophoton intensities and 95% confidence interval ($n = 102$). $A_0 = 12000$ [Counts per 10000 pixels], $k_1 = 0.7$ [h^{-1}], $k_2 = 0.25$ [h^{-1}]. Measured wave-length: 280 – 650 nm.

Equation 1 is not only a convenient equation to calculate a parameter of psi, it is considered to be deeply related to the nature of psi. The left term is a quantity of psi and the right term consists of physical values only. The magnitude of psi is directly described by physical values only. Psi can be connected to modern physics through this equation (Figure 2).

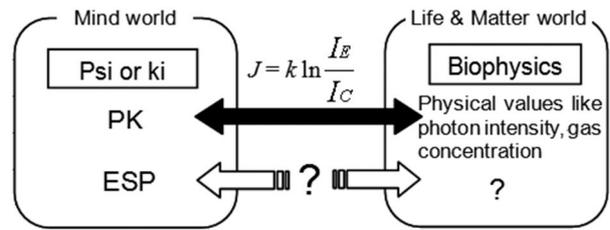


Figure 2. Psi or ki and biophysics. The author and his co-workers have not successfully described the magnitude of ESP yet using only physical values.

If the magnitude of PK is a logarithm of physical values, it will be possible to use other physical values, not only biophoton intensity. If a study is made to identify which physical values are suitable for describing the magnitude of PK, it may be possible to obtain new findings about the mechanisms of psi.

Here, the author tries to discuss magnitude of healing (bio-PK) using colony formation of cultured cells as an example.

Radin, *et al.* (2003) tested non-contact healing, specifically Johrei therapy, with human astrocytes and found the average colony formulations were 22 in experiments and 17 in controls. Therefore, J value can be calculated as $J = \ln(N_E/N_C) = 0.258$. Yamauchi *et al.* (1996) tested non-contact healing, laying-on-of hands, with HeLa cells which had been exposed to X-ray dose of 10 Gy and got average colony formations of 43.6 in experiments and 23 in controls. J value can be calculated as $J = \ln(N_E/N_C) = 0.639$.

The J value in one of the cucumber studies was $J = 0.147$ (Kokubo & Yamamoto, 2007a). While any comparison that can be made is only rough because experimental conditions of these three studies were different, it may be reasonable to look at them together.

A coefficient k of the J value should be defined if it is desired to compare results of different experiments. Fortunately, F003, one of the healers in the cell experiments done by Yamauchi *et al.* in 1996, remained active for many years after their experiments. Kokubo and Yamamoto (2007b) were able to test F003 by the biophoton measurement method, and obtained $J = 0.134$. Here, this value is used as a reference point for comparison with the cell experiments (Yamauchi *et al.*, 1996; Radin *et al.*, 2003) and cucumber experiments (Kokubo & Yamamoto, 2007a). J value of F003 is nearly equal to the average J value of 14 healers ($J = 0.142$) in Kokubo & Yamamoto's



study. Therefore, it can be assumed that the average healing powers are equal in all experiments, and the coefficient k of the cucumber experiments is $k = 1$, then k of the cell experiments can be calculated using Equation 2.

$$J = k \ln \frac{N_E}{N_C} \quad (2)$$

Those values are listed in Table 2 and they suggest that J value of the cell experiments is 2 to 4 times that of cucumber experiments.

In the above discussions, it is assumed that J value also has a role as an index of unknown physical mechanisms which exist as background mechanisms of healing (bio-PK) phenomena. As such, it is possible to compare healing effects against various kinds of illnesses. If no parameters, such as J value, which seems to relate to common background mechanisms, are used, it is difficult to discuss whether a higher ratio of recovery from a certain illness is caused by a strong healing power or caused by a certain biochemical reaction system which has higher sensitivity for that healing power.

Table 2. Coefficient k in cultured cells and cucumber piece experiments (Kokubo <i>et al.</i> , 2011a, 2011b).						
References	Bio-sensors	No. of Healers	N_E	N_C	$k \ln(N_E/N_C)$	$1/k$
Yamauchi <i>et al.</i> (1996)	Colony formulation of HeLa cells	6	48.58 ($n=12$)	23.00 ($n=4$)	0.639	4.5
Radin <i>et al.</i> (2003)	Colony formulation of human astrocyte cells	4	22 ($n=?$)	17 ($n=?$)	0.258	1.8
References	Bio-sensors	No. of Healers	I_E	I_C	$k \ln(I_E/I_C)$	k
Kokubo & Yamamoto (2007a)	Biophoton intensity from cucumber pieces	14	88192 ($n=106$)	75890 ($n=106$)	0.142	1

5. Direct Measurement of Bio-PK Field

Moreover the author and collaborators have developed two new measuring methods for healing (bio-PK) power using cucumber pieces; one of them is the gas measurement method in which concentration of cucumber gases (odor) are measured (Kokubo *et al.*, 2009; 2010a; 2010b; Kokubo & Takagi, 2010), the other is the fluorescence measurement method in which fluorescence matters generated on the surface of cucumber pieces are measured (Kokubo & Yamamoto, 2012; Kokubo *et al.*, 2012). In this section, the author describes results of measurements on bio-PK field around a human body using the gas measurement method.

A healer did non-contact healing to increase cucumber gases for 30 min against the target bio-sensors (cucumber pieces) on a table in front of him. Additionally, for measurements of his bio-PK field, many bio-sensors were arranged at 25 cm or 50 cm intervals in front-back and left-right directions

of the healer (measured area was within 2.5 m). Two psychics and 5 non-contact healers participated. They showed non-Coulomb potential distributions around them during their healing tasks (Kokubo *et al.*, 2010c; 2011a; 2011b; Kokubo, 2011). Figure 3 shows average distributions of J values (of gas concentrations) in which the participant was located at the middle of the figure. Red marks increase areas where gas concentration of experimental samples is larger than controls, blue marks decrease areas where gas concentration of experiments is smaller than controls, and green marks zero areas where there is no difference in gas concentrations of experiments and controls. The distributions of the bio-PK field were wave-like distributions in which wavelengths were about 1-1.5 m and they had anisotropy between front-back and left-right directions. Moreover, there were reverse potential areas (blue areas) where healing effects were reversed.



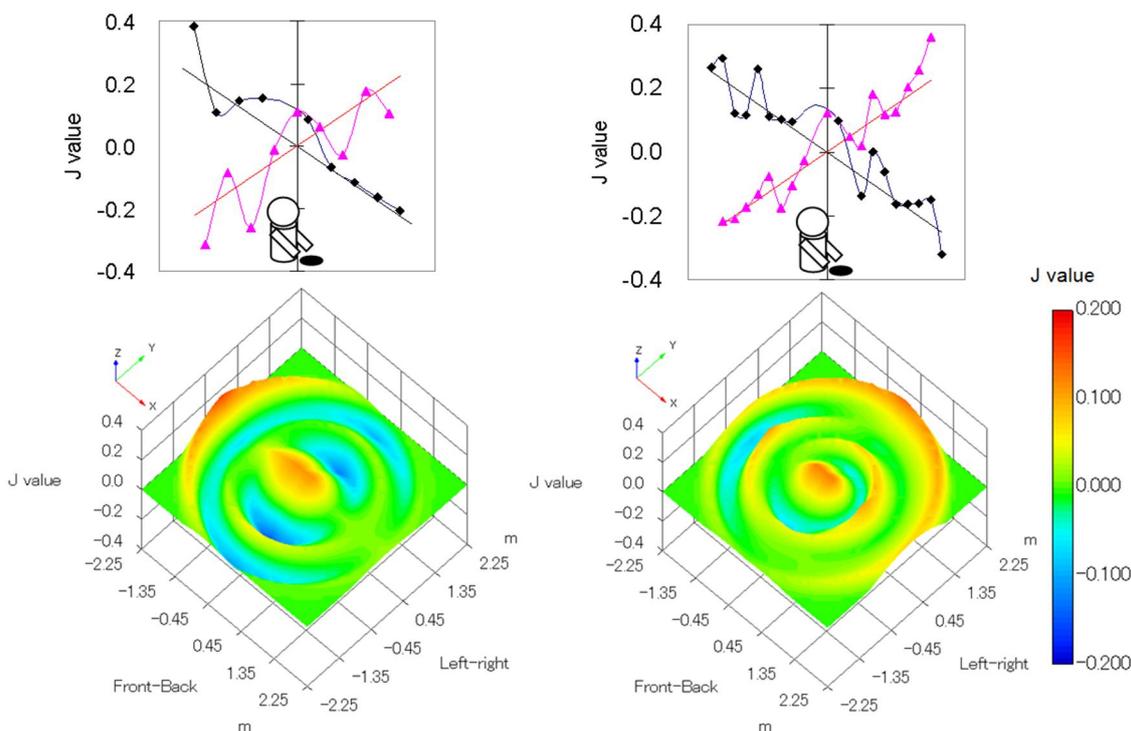


Figure 3. Left: Average of 2 psychics (each point is the average of 4 data). Right: Average of 5 non-contact healers (each point is the average of 10 data). Original spatial resolution was 50 cm (psychics) and 25 cm (healers). Based on data in front-backward and left-rightward, 3D graph is drawn using linear interpolation of points which have the same distances from the origin. The distribution of psychics is symmetric in the left-right direction and it is considered that this symmetric wave pattern is the basic pattern of the bio-PK field. There is a spiral in the right figure for the healers. The reason for the spiral pattern is unknown; however, some possible explanations are (1) an artifact of the calculation, (2) an interaction with electric devices which were operating during the healing experiments, and (3) the healers controlled their power (i.e., way of healing) in a spiral.

6. Discussions on the Wave-like Distribution

6-1. Wave-like distribution means the layered structure

It can be said that a wave-like potential distribution is equal to a layered structure (Figure 4). Some spiritualists or mystics claim that a person's body is surrounded by a layered structure of bio-energy fields; for example, some mystics claim that there is an invisible body outside the physical body and these invisible bodies are called etheric, astral, mental or causal bodies. Qigong and Reiki masters or energy therapists often claim they can feel the border surface of a different ki energy around the human body. Their empirical claims are considered as alternative expressions of the wave-like potential. In other words, the wave-like potential distribution is well-known as a layered structure empirically. However, the wave-like potential distribution means that all "layers" are the same essentially although their directions and amplitudes of effects differ from each other. The wave-like distribution does not support an empirical claim that layers are different entities.

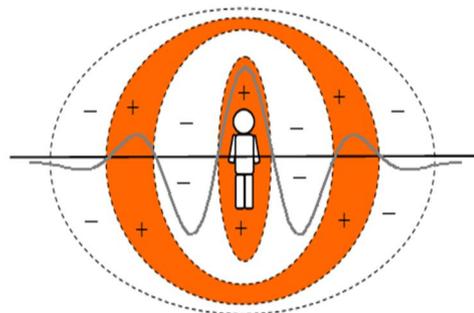


Figure 4. The wave-like distribution is the layered structure.

Figure 4 shows a model of average distributions, but actual wavelength and amplitude of trial data are not the same. Moreover, healers using laying-on-of-hands have a tendency to show a large amplitude at the middle as in Figure 4, while qigong healers have a tendency for amplitude to become larger on moving away from the healer as in Figure 5. The number of waves (number of layers) and amplitude are not constant, and they are considered to depend upon the healing way or the healer's conditions.



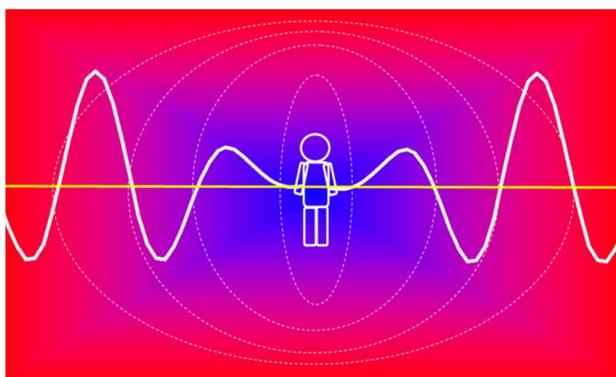


Figure 5. Emission type distribution of qigong healers.

6-2. Psi effects are cancelled mutually

Wave-like potential distribution of bio-PK has reverse potential areas. If many wave-like distributions are averaged at random, the positive and negative effects negate each other and the average of the effects approaches zero. For example, when several healers try to do healing against a certain client simultaneously, if their waves are not coherent, their healing effects will negate each other.

Even if the number N of participants increases, the psi effect (PK effect) does not necessarily increase in proportion to N . Rather the magnitude of the psi effect per unit number becomes small. These well-known facts are inevitably drawn from the wave-like potential distribution.

It is considered that effects of psi of many people are always cancelled mutually and not conspicuous in everyday life. If waves of sitters in a sitting séance become coherent at a place coincidentally, an anomalous phenomenon may occur there. However, it is expected that such phenomena occur at random and their repeatability is less.

In addition, if PK has relationships with ESP, information transfer of ESP will be affected by the wave-like distribution. It is expected that the ESP process is disturbed by non-stability of the wavelength and amplitude of the psi field and that cancelling of ESP information or psi-missing occurs.

6-3. Plural unknown factors exist

Approximate equations of the spatial distributions shown in Figure 3 can be made. Especially, the left figure for psychics is very symmetric in the left-right direction, and it is easily approximated with wave functions. Kokubo *et al.* (2011a) have already discussed

approximate equations using a quantum harmonic oscillator model, and Equation 3 was presumed as a source equation for healing phenomena.

$$\frac{d^2 J}{dz^2} + (\lambda - z^2)J = 0 \quad (3)$$

Here, z is a dimensionless general coordinate and λ is a parameter which represents a state of the system. In the equation of motion, the term λ corresponds to a Hamiltonian and the term z^2 corresponds to the potential of the central force.

The terms λ and z^2 are indispensable to explain the observed wave-like distribution of J values. However, at present, it is not known what the terms λ and z^2 are. Although the author has just argued about the magnitude of psi using J value, Equation 3 suggests that there are plural unknown factors which cannot be understood, and that those unknown factors follow their own physical laws. This suggestion stimulates the imagination. There is a possibility that researchers cannot explain psi phenomena only by adding a new particle “psi” or a hidden parameter “psi” to modern physics.

7. Final Remarks

In this paper, through considerations on the studies of bio-PK made by the author and his co-workers, the possibility was pointed out that plural unknown factors were related to psi phenomena and those unknown factors were connected to each other by their own physical laws. Hence, a biophysical approach is considered as useful to study physical mechanisms of psi.

Finally, the paper noted that distributions such as in Figure 3 were static distributions averaged for 30 min. The dynamism of bio-PK fields cannot be measured using present day methods. There is no term for time in Eq. 3. However it is expected that equations for bio-PK including a term for time can be made if the details of the dynamism of bio-PK are successfully measured. At that time, researchers will be able to discuss tunneling phenomena in psi, tunneling being one of the general properties of a wave, and wave transfer to far places. Development of a user-friendly real-time sensor is needed for progress in future psi research.



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