

БИОФИЗИКА

UDC 577.3

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THE PHYSICAL SENSE OF SCHÖDINGER EQUATION IN THE CONTEXT OF THE SYNERGETIC CONCEPTION

(Presented by Academician M. P. Lisitsa)

Conceptual basis of the physics of the alive [1—5] is formed by the idea that any independently functioning living system is both a macroscopic quantum object and a maser whose pumping is performed by metabolism due to the mechanism named «dissipative structure heirarchy». This approach gives an insight into the organism macroscopic integrity according to genetic information (formation due to the coherent nature of effective long-range forces) as well as its diversified differential stability which is realized due to the quantum mechanic principles of identity and discreteness [6].

These ideas are based on positive experience of quantum medicine whose patent technology allows for rehabilitation of body's functional condition by electromagnetic field (EMF) action on the system of biologically active points (BAPs) within the frequency range of $(5 \div 7) \cdot 10^{10}$ Hz and with the intensity from 10^{-2} W/cm² to 10^{-18} W/cm². Quantum medicine has originated [7] and is being developed owing to the longterm scientific studies in traditional medicine, biophysics, biochemistry, genetics, molecular biology, immunology, cytology, embriology, physics, radiophysics, cybernetics, mathematics, etc. Within the last three years more than 190,000 patients, and among them — many cases incurable from the point of view of drug therapy, were successfully healed by quantum medicine. Apart from the extremely high sensitivity of bioobjects to the external mm-range EMF with the intensity near quantum limit, the ideas of physics of the alive are supported by a great number of the other data. Among them there are the so-called «resonances» in action spectra, selection rules in helicity for the excitation of these resonances, sensitivity of «pre-living» systems (aminoacids) to mm-range radiation (also resonance), determination of the role played by DNA in the mechanism of interaction between the EMF and the living system, revelation of numerous «mystical» aspects of ancient Chinese medicine, determination of the role of water as a «physical vacuum» of the living matter, reduction of enclosed phase spatial dimensionality in the course of treatment by Milliwave Resonance Therapy (MRT), the efficiency of the theory of catastrophes under purposeful bypass of the fold-type singularities by patient's condition vector in the course of treatment, peculiar features in the body's rehabilitation mechanism under MRT effect including its immune status, etc.

According to our* ideas, the mechanism of formbuilding in specific living systems operates due to the stability of limit cycles which are created in organism's coherent electromagnetic field by the running waves whose frequencies belong to the characteristic eigen-frequencies of human body [4]. In every closed trajectory of these limit cycles (in a human body they are represented by Chinese Channels) the integer number of all wavelengths, which exist in this trajectory must necessarily be involved.

To be universal this dual quantum-synergetic approach should also be valid on the other levels of quantum organization of the nature: nuclear,

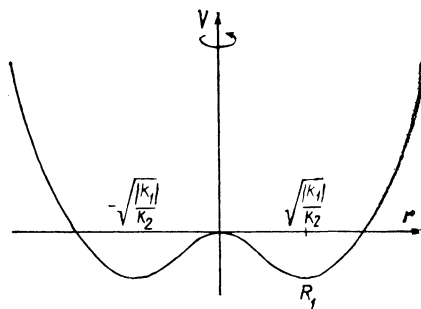
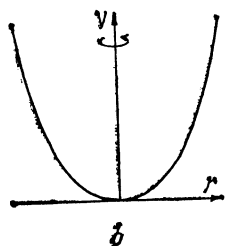
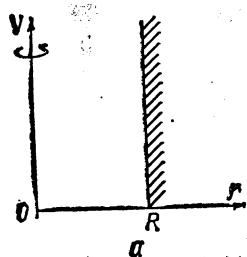


Fig. 1

Fig. 2

atomic, molecular, i. e. it should be embodied in the very core of quantum mechanics.

And, as a matter of fact, it is the true.

Physical concepts of quantum mechanics were given by N. Bohr. As it is known, his postulate on angular momentum quantization is written as: $\oint p dq = nh$, which in the case of a circular orbit gives $2\pi R p = nh$, or, denoting the length of the orbit as $L = 2\pi R$, we have

$$\frac{L}{\lambda} = n, \tag{1}$$

where $\lambda = \frac{h}{p}$ is de Broglie wavelength for an electron in the atomic orbit.

Thus, the physical condition of atomic stability given in the above N. Bohr postulate is coincident with the condition of organism stability provided by the physics of the alive.

The quantization formalism is known to be rather ungrounded in Schrödinger version of quantum mechanics [6]. The author of quantum mechanics also expressed his concern about this fact.

Let us consider «classical», idealized problem of quantum mechanics: the motion of a spinless particle with mass m in centrally symmetrical, infinitely high potential with radius R (Fig. 1, a).

In this case radial part of Schrödinger equation for wave function Ψ_R in spherical coordinates for $l=0$ is known to have a form of

$$\frac{\hbar^2}{2m} \frac{d^2 U}{dr^2} + EU = 0,$$

where $U = \Psi_{Rr}$.

Boundary condition $U(r=R) = 0$ restrict possible solutions to this equation:

$$U \sim \sin kr \text{ at } kR = n\pi, n = 1, 2, \dots,$$

where $k = \frac{\sqrt{2mE}}{\hbar}$.

* The idea is developed in cooperation with V. V. Gizhko

Thus, we have

$$E_n = \frac{(n\hbar\pi)^2}{2mR^2}. \quad (2)$$

This process of quantization is the most vulnerable position of Schrödinger's quantum mechanics: the most important and experimentally controlled result is based upon the postulate of de Broglie standing waves which has no physical grounds.

There is, however, a possibility to avoid the artificiality in this most fundamental part of quantum theory, bearing in mind the findings of the physics of the alive and *N. Bohr* ideas. The essence of the change consists in the transition from static to dynamic potentials, i. e. it is created by the very mechanism of interaction between structural elements of dissipative (from I. Prigogine's viewpoint) systems.

From this standpoint, the potential of the above type can be substituted e. g. for the standard potential from Landau theory of phase transitions [6], which coincides with Haken's dynamic potential [8] for the theory of self-organization (synergetics):

$$V(r) = \frac{k_1 r^2}{2} + \frac{k_2 r^4}{4},$$

where the parameters k_1 and k_2 describe the open system in the course of its interaction with the physical vacuum.

It corresponds to anharmonic oscillator with a cubic term in the expression for the force:

$$F(r) = -k_1 r - k_2 r^3.$$

At $k_2=0$ we have a usual isotropic oscillator (Fig. 1, *b*) with equidistant energy levels. This picture does not show qualitative changes even in the case of a cubic term provided $k_1 > 0$.

But, at $k_1 < 0$ and $k_2 > 0$ the form of potential presents qualitative changes (Fig. 2).

In such synergetic potential the limit cycle is stabilized at $\frac{L}{\lambda_n} = n$ (Fig. 3), where L is the length of a limit cycle trajectory (at the rotational symmetry $L=2\pi R_1$), and λ_n is the de Broglie wavelength.

Putting (for the sake of illustration) $V=0$ in the orbit region we obtain:

$$\lambda_n = \frac{2\pi}{k_n} = \frac{2\pi\hbar}{\sqrt{2mE_n}};$$

$$n = \frac{L\sqrt{2mE_n}}{2\pi\hbar};$$

$$E_n = \frac{4\pi^2\hbar^2 n^2}{2L^2 m} = \frac{(n\hbar\pi)^2}{2m} \cdot \frac{4}{L^2} = \frac{(n\hbar\pi)^2}{2mR^2}. \quad (3)$$

Thus at limit cycle radius $R_1 = \frac{L}{2\pi} = \frac{2R}{2\pi} = \frac{R}{\pi}$ formul (2) and (3) coincide.

I understand that real potentials used in nuclear, atomic and molecular physics are essentially different from the one in (Fig. 1, *a*). But it belongs to the limited number of potentials wherein quantization condi-

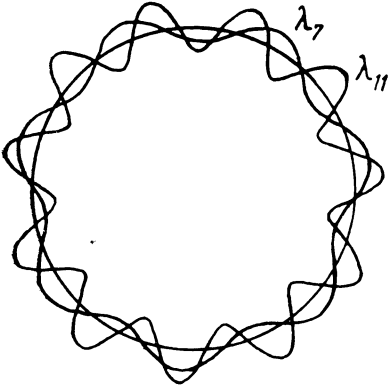


Fig. 3

ons have a simple analytical form. In real situations the picture is much more complex, but it will find its reflection in the dispersion relation for de Broglie waves: $E = \hbar\omega = \frac{\hbar^2 k^2}{2m} + V$, and the limit cycle form must not necessarily be a circle. Hopefully, this conclusion may be universal, i. e. in all specific cases the inviolability of quantum mechanic results will be retained. The utilization of a synergetic potential and principles of dynamic stability of limit cycles allows quantum mechanical formalism to be filled with physical content. The transition from static to dynamic potentials created in stable dissipative systems denotes the transition to dynamic stability of structural elements of matter (nuclei, atoms, molecules, living matter) due to their openness to physical vacuum [5]. In this case de Broglie waves serve as an order parameter in the solution to Schrödinger equation.

In conclusion it may be said that the same «synergetic approach» used for quantum systems at nuclear level eliminates methodological problems connected with the formation of self-consistent potential and shell structures of a nucleus.

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Received 04.02.93

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ФИЗИЧЕСКИЙ СМЫСЛ УРАВНЕНИЯ ШРЕДИНГЕРА В КОНТЕКСТЕ СИНЕРГЕТИЧЕСКОЙ КОНЦЕПЦИИ

Распространение критерия устойчивости объектов квантовой физики живого — целочисленного значения длин волн всех собственных характеристических частот организма на замкнутых траекториях китайских меридианов — на стандартные уровни квантовой организации природы позволяет обосновать идею самосогласованного потенциала синергетического типа. При этом формализм Шредингера и постулат Бора о квантовании угловых моментов наполняются физическим содержанием.

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ФІЗИЧНИЙ СЕНС РІВНЯННЯ ШРЕДІНГЕРА В КОНТЕКСТІ СИНЕРГЕТИЧНОЇ КОНЦЕПЦІЇ

Поширення критерію стійкості об'єктів квантової фізики живого — цілочисельного значення довжин хвиль всіх власних характеристичних частот організму на замкнених траєкторіях китайських меридіанів — на стандартні рівні квантової організації природи дає змогу обґрунтувати ідею самопогодженого потенціалу синергетичного типу. При цьому формалізм Шредингера та постулат Бора про квантування кутових моментів наповнюється фізичним змістом.