

ELECTRODYNAMIC MODEL OF THE HUMAN ORGANISM'S ELECTROMAGNETIC FRAME

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Nowadays, existence of Chinese meridians (channels) is explained as formation of trajectories of running electromagnetic waves when they move in the human organism [1, 2]. From this point of view, keeping in mind the features of the human anatomical structure, we can establish correspondence between the characteristics of a limit cycle (periodic in time and stable structures of the organism's electromagnetic coherent microwave field) and the features of the classic acupuncture meridians topography [3].

Appearance of the mentioned limit cycles is connected with generating the resonant by nature and discrete by its spectral composition radiation in a system, "saturation active cellular centres — linearly absorbent medium" [2].

As we know, [4—6] the process of generation of electromagnetic radiation in the presence of active medium can be considered as an analogue of a phase transition. In this paper we have tried to investigate the problem of origin of Chinese meridians as a real phase transition. This investigation is based on the suggestion that the charges or charge complexes which are the source of coherent microwave electromagnetic field connect with a cell membrane (as the oscillation frequency of a cell membrane conforms to mm-range of electromagnetic spectrum [1]). The quantity of the charges or charge complexes connected with the membrane can be considered as a thermodynamic parameter and as it grows, from some point, the oscillation of adjacent cells' membranes and internal states of the charge complexes become correlated. This leads to a sharp change of such thermodynamic index of physical medium as dielectric constant [5, 7]. This phenomenon is usually characterized as a distinction between average active electric field and average macroscopic one [§ 11, 7]. It also causes a change in polarizability of a medium unit, in our case a cell membrane, according to Clausius-Mossotti equation and medium refraction index in accordance with Lorent-Lorentz formula. In this model we suggest that stated connection between the charges or charge complexes and a cell membrane occurs along a meridian, which determines its location in the organism.

Formation of the meridians, according to our model, is a phase transition of the second order (because polarizability of a volume's unit of medium is found as a second-order derivative of thermodynamic potential with respect to the electric field strength). Phase transitions can be interpreted as development of unstable fluctuation of the thermodynamic parameters limited by nonlinear interaction of the medium units (the cells' membranes whose charges or charge complexes connect with as factors of the meridian's formation). This leads to the final, for phase transition, the thermodynamic state. This interpretation makes obvious the statement that parameters, which describe electromagnetic field, and which in its turn forms the interaction strength of adjacent cells' charged membranes, leading to correlation of their oscillation and internal states of fixed charge complexes, have time behaviour with the developing instability, limited by non-linear interaction of electromagnetic field modes (regime of generation, [4—8]), which corresponds to the results [1—2]. In order to connect more closely our investigation with the ideas of the work [3], let us emphasize the following observation. The meridian's coherent electromagnetic field has time behaviour, which describes the kinetic process of meridian's formation as a phase transition

in the phenomenological way, which we use for describing electromagnetic processes in the human organism by means of introducing the medium's dielectric constant. As we approach the point of the phase transition, the correlation radius of electromagnetic field parameters grows. Keeping in mind that the width of the resonances in the functions of action of mm-range electromagnetic radiation on the human body through the acupuncture points is small [1], we can conclude that dissipative effects in the living medium are relatively low. It means that the correlation radius is comparable with the typical size of a meridian. As charges or charge complexes' interaction strength is determined by electromagnetic field, their correlation radius grows, too. The fact [1, 9] that the countable quantity of quanta of external electromagnetic field are able to cause the therapeutical influence (the intensity of radiation in the case of Microwave Resonance Therapy — MRT — is about $10^{-20} \text{ W/Hz} \cdot \text{cm}^2$) shows that charges, which are the source of coherent electromagnetic field, move in a quantum-mechanical way. According to what is mentioned above about the correlation radius of interaction strength, this movement of charges is described for coherent states or by a Wave Function, which in such a way acquires sense for macroscopic dimensions of the body or by Density Matrix, if entropy of the meridian's quantum-mechanical state is not equal to 0. Energy migration along the meridian, as we see it, is described by such notion as a "light-exciton" and appearance of the meridian is interpreted in this approach as a quantum-mechanical process with introducing a new phase — light-excitons, which, if we take into account the quantum-mechanical dualism "wave-particle", can be considered as quasi-particles.

Phase transitions lead to the change in a physical system's symmetry. In our case, the geometry of the meridian differs from the local geometry of other parts of the human body. The geometry of the meridian determines some quantum numbers of the light-exciton. In a cylindrical symmetry approximation they are: the momentum projection on the meridian axis, the angular momentum projection on the same direction, a radial quantum number which doesn't have a direct physical meaning, and also quantum numbers that are related to internal symmetries. So the kinetics of the phase transition, which we examine here — quantum-mechanical coherent state of light and substance along the meridian — can be considered as spontaneous break of dynamic symmetry. This explains the movement of the light-exciton, definite in direction along the meridian.

The model of the meridian's formation as the second-order phase transition, described by a wave function of coherent state, which be interpreted as an order parameter, allows us to estimate in a linear approximation the track diameter of the meridian, which can be considered as a directing system of electromagnetic waves of a waveguide type. We can connect the mode of electromagnetic wave, spreading in a suggested guiding system, using quantum-mechanical dualism "wave-particle", with the set, may be incomplete, of the light-exciton's quantum numbers.

The resonant therapeutical influence by countable quanta from an external source of electromagnetic waves [1, 9] may be interpreted as resonant penetration through the barrier of external mm-range photon. The role of the barrier lies on the entrance to the waveguide, which is physically realised as an acupuncture point. In the classic interpretation this case needs that along the meridian the refractive index of the medium (in a homogeneous approximation) is equal 1 on a therapeutical frequency, because, in the scope of classic approach, in this case there is no reflection of electromagnetic wave from the boundary "air-skin surface". Dispersion relations between energy and momentum projection of the light-exciton on the meridian axis can be interpreted, fixing the other quantum numbers of a quasi-particle, as a dispersion relation for the appropriate mode of waves in the directing system of the waveguide type with the known tensor of dielectric constant, which together with the tensor of

magnetic permeability determines the refractive index of the medium on the given frequency of external electromagnetic field for the waves that are examined. This interpretation, from one side, allows us to use the method of obtaining in a linear approximation the dispersion relations [§ 65, 10] for prolonged, but final systems. From other side, the dualism “wave — particle”, which has the character of using De-Broigle’s hypothesis to a classic electromagnetic wave in a substance with the boundary “air — skin surface”, allows to avoid the theoretical problem on quantizing electromagnetic field in the medium with non-zero imaginary part of dielectric constant in the presence of the boundary between two mediums [11], while one of them, the meridian’s track, has the symmetry different from cubic.

Narrowness of the lines in the spectrum of the therapeutical action [1] allows us to say that non-coherent radiation takes relatively small part in phenomenologic description of this phenomenon. Thanks to this, in the final answer for the dispersion relation by the method explained in [§ 65, 10] we can ignore imaginary part of the complex index of refraction of the medium, responsible for dissipative processes and generation processes in a linear approximation in the classic description of electromagnetic waves’ dynamics in a substance. In this way, we can get the general relation for homogeneous directing system of cylindrical symmetry:

$$n_{\alpha}(\nu)v = c \mu_n^k / \pi d,$$

where c is velocity of light, d — meridian’s diameter, μ_n^k — characteristic eigenvalue of boundary problem on a circle with unit radius for operator: $\Delta_2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$, where x and y are coordinates of cylindrical cross-section of the meridian’s track, α is a complete set of quantum numbers of a light exciton, some or all of which determine a mode of electromagnetic wave in a directing system of the waveguide type, $n_{\alpha}(\nu)$ is a real part of refractive index of the medium in the area of meridian (according to what is said before $n_{\alpha}(\nu) = 1$ at a therapeutical frequency).

Boundary conditions of boundary problem for operator Δ_2 need further investigation, which can be done referring to correspondence between the classic and quantum-mechanical approach to the problem. Analysis of solving the classic problem of spreading electromagnetic waves along dielectric waveguide shows that electromagnetic field exists outside the cylindrical waveguide [p. 288, 12] and attenuates asymptotically exponentially, the further one gets from the waveguide axis. Quantum-mechanical correspondence to this solution can be interpreted as transitional layer between coherent part of electromagnetic field and non-coherent, which, according to accepted approximation (ignoring imaginary part of a medium refractive index) is absent in the space of the meridian. Asymptotic exponential attenuation of the field outside the waveguide permit us to consider it to equal 0 on the side bound of the meridian, which is, in fact, the infinitely narrow transitional layer and it corresponds to approximation of neglecting the contribution of the non-coherent part of the field in dissipative processes of this phenomenon. Zero boundary conditions for the problem on characteristic eigenvalues for operator Δ_2 in the presence of cylindrical symmetry determine μ_n^k as k -root of n -Bessel’s function. Actually, linear version of the theory justifies in the resulted evaluation the neglecting of the parameters of generation, which is described quantum-mechanically as a strictly non-linear phenomenon. It doesn’t give the opportunity to derive the root consistently. But we already have reasonable matching with the observed size of acupuncture “point” with diameter $d = (0.32 \div 0.57)$ cm and with the known values of therapeutical frequency $\nu = (40-70)$ GHz [1] for the lowest wave modes $n=0, k=1, \mu_0^1 = 2.4$. At last, the present model allows us to guess that suggested mechanism of meridian’s formation is quite universal for the organism,

is not connected with definite cytologic distinctions and allows the organism to form stationary as well as temporary meridians. This supposition introduces the concept of non-stationary "electromagnetic frame" of the organism within the conception of self-consistent potential of entire organism, stated in [1, 9], and puts forward the problem of looking for a "roving" meridian as a temporarily formed electromagnetic structure in the organism of the limit cycle type.

In conclusion we would like to say that results of our work are supported by experimental investigations [13], which show that the modulus of the skin refractive index in a region of acupuncture point differs from the values in other points on the skin.

The difficulty of a full experimental examination of the stated above attempt to explain the process of meridian's formation as the second-order phase transition is that usual methods of influence on the meridian are characterized by so great intensities of influence parameters, which lead to destruction of coherent state deep into the meridian, and therefore the results, that we got, must be attributed to the state of transitional layer from non-coherent to coherent state. This destruction of coherent state deep into the meridian and its restoration in the form of a phase transition is phenomenologic difference, in the scope of the model, between the classic methods of influence on the meridian, which are characterized by appearance of thermodynamic flows in the region of destruction of coherent state, and influence of external resonant electromagnetic field of low intensity (MRT), which induces a phase transition from a long living metastable thermodynamic state and has a character of formation of macroscopic coherent state. Examination of induced phase transition by external laser radiation, described in [6], can be generalized to our quantum case and analysis of the results of generalization can explain the change in form of a resonant line of therapeutic influence of electromagnetic radiation [1].

LITERATURE

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