

# NONLINEAR ELECTROMAGNETIC DYNAMICS

## UNDERLYING MERIDIANS IN LIVING SYSTEMS

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The nonlinear mechanism of charge transport is discussed which is based on the concept of Davydov's solitons in macromolecules, such as DNA and polypeptides [1]. Such solitons are nonlinear states of electrons or AMID-1 excitations of peptide groups, bound with the local distortion of macromolecules, which can propagate without energy dissipation on macroscopic distances and provide energy and charge transport at physiological temperatures. The main properties of solitons and their bound states are discussed as well as conditions of their existence.

The effect of external periodic field on the charge transport processes in macromolecules is studied. It is shown that the external electromagnetic radiation has a nonthermal resonant effect on soliton dynamics, and that in the spectrum of the radiation there is a set of frequencies, at which electrons in soliton states change their dynamics drastically and can dissociate or cause the transition to chaos. It is also shown that in the presence of the external electromagnetic field periodic in time, solitons in macromolecules under certain conditions acquire ratchet-type behaviour, i.e., they exhibit a uni-directed (in average) motion of particles in the external unbiased field [2]. Thus, a harmonic unbiased (with the zero mean-value) field causes oscillations and a drift of solitons [3]. This phenomenon has a threshold with respect to the intensity and the frequency of the field.

Therefore, nonlinear charge transport processes in macromolecules in the presence of the periodic in time field acquire completely different dynamics as comparing with the conventional mechanisms. This inevitably affects the metabolism of the biosystem and can constitute one of the mechanisms of the bioeffects of the external electromagnetic fields [4] and explains the mechanism of nonthermal millimeter wavelength resonant therapy.

It is shown that the propagation of charged solitons along macromolecules is accompanied by the frequency specific electromagnetic radiation, which contributes to the endogenous electromagnetic field in the organism [5]. This field is self-consistent with the metabolism of the organism and plays a role of synchronizing charge transport in the redox processes. Such a field in a system of complex optical properties and geometry can be self-focused in the way, similar to optical wave-guides.

Based on this mechanism, a hypothesis is discussed on the nonlinear mechanism of the origin of self-organisation in living systems. Within this hypothesis the appearance of the dynamical order can be reached through the flows of matter, energy and information, which can be non-uniformly spread over the organism due to self-focusing of the electromagnetic field induced by the charge transport of redox processes and correlated coherence domains of interfacial water [6]. Endogenous electromagnetic field is self-trapped in these domains and forms the dynamical pathways as wave-guides, along which these flows can occur via soliton mechanism. The elongated coherence domains form quasi-one-dimensional arrays, bound by Josephson-like junctions between the domains, and electromagnetic signals can propagate along such arrays in the form of nonlinear soliton-type pulses. These pathways can play the role of meridians, in which solitons can be stimulated either by intrinsic dynamics or by external stimuli and can be visualized in the infrared range as bright or dark solitons [7]. The formation of such pathways is the consequence of coherence - noncoherence transitions occurring in the biological cycle of the organism. A rational therapy

appears then to be the induction of conditions for soliton existence necessary for maintaining the coherence of the system [7].

According to the above, the meridians and acupuncture points postulated in the Eastern medicine, could be just hierarchical levels of the endogenous electromagnetic structure of the living organism, and, therefore, they reflect energetic organization of the system. Such network can be excited from outside at particular nodes (acupuncture points) by external stimuli. The energy absorbed at the node, triggers energy propagation along the corresponding waveguide in the form of solitons. Energy absorbed or leaking out the pathway(s), excites the coherence domains increasing their energy. Thus, coherence domains can collect low-grade (high entropy) energy from the environment in whatever form and transform it into high-grade (low entropy) energy which can reach the frequency of the light interval. The source of the externally supplied energy could be whatsoever (ultraweak millimeter wavelength radiation, acupuncture needles, moxibustion, etc) yet the stored energy assumes the form of *internal light* able to govern the self-organisation of the organism.

The external energy could be supplied also by photons, which in this case are the triggers for the autonomous production of the internal light. The fact that one can visualise colours long time after eyes are closed, means that the colours are produced by the internal activity of the body as manifestation of the trapped electromagnetic field. It can interact with light sensitive structures in the body and excite pulses (solitons) which then propagate along their waveguides. In healthy state one can see photons of all wavelengths circulating along the respective pathways, and no photons are emitted out. Disease implies the energy disbalance, block in the energy flows in human system, causing 'disharmonic states', which means partial loss of coherence, and which is connected with the interruption in the functioning of some pathways, jamming of some waveguide(s) or leaking of photons of some wavelengths outside [8]. Thus, light as a trigger and a probe of the internal dynamics of living organisms, can be used as medical therapy [8].

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