

QED coherence in liquid water and the dynamics of the organization of water in living matter

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In the conceptual framework of Quantum Electro-Dynamics (QED) it is possible to prove the following theorem:

- An ensemble of N two-level microscopic components (atoms, molecules and so on) coupled with the electromagnetic (e.m.) field becomes dynamically unstable above a critical density $(N/V)_{\text{crit}}$ and below a critical temperature T_{crit} ; the coherent state, where the N components oscillate in unison between the two individual levels in tune with a resonating non vanishing coherent e.m. field within a “coherence domain” (CD) whose size is just the wavelength of the e.m. field, becomes a lower energy state with respect to the non coherent state where the components are independent, uncorrelated in phase and bound by static forces only. This new state becomes the “vacuum” of a new phase and the difference of energy (energy gap) between the two vacua gives rise to the appearance of a latent heat in the phase transition, that is thus a first order transition. The above theorem can be generalized to many level components such as water molecules. This condensed phase can exist only when the thermal energy kT is unable to put through the collisions all the components out of tune and thus push them in the non-coherent gas-like phase. At a given temperature, T , as in the Landau model of superfluid helium, a fraction $F_c(T)$ of all components belongs to the coherent state, whereas the non coherent fraction $1-F_c(T)$ will fill in a gas form the interstices among the CD's. This two-phases fluid can describe the liquid state. In the particular case of water, it has been shown that the coherent oscillation occurs between the molecular ground state and an excited electron state 5d at 12.06 eV. Recalling that the molecule gets ionized at 12.60 eV, electrons in the high energy extreme of the oscillation are very loosely bound and then quasi-free. Thus, this plasma of quasi-free electrons might be easily excited by small amounts of external energy producing vortices, whose angular momentum is obviously quantized, giving rise to a discrete spectrum of coherent excited states, characterized by magnetic moments which get aligned by the Earth magnetic field. The above vortices are cold vortices, being coherent excitation of a coherent plasma of electrons. Thus, these excited states cannot decay thermally, because of the existence of the energy gap, and cannot decay either electromagnetically, since within the CD the e.m. field has a negative squared mass $m^2 = \omega^2 - k^2$ (this phenomenon produces the self-trapping of the e.m. field in the CD) and cannot couple with external e.m. fields. The only decay channel implies the release of the excitation energy to specific molecules in a resonant way, so that the CD excitation induces the activation of specific biomolecules. The above results imply that the excited states of a CD of liquid water have a very long life time, so that it is possible to store a large amount of energy in the CD; the alignment of all vortices induced by the Earth magnetic field implies that different excitations don't interfere destructively and can sum up constructively giving rise to a large energy storage. So the water CD is a machine able to transform a low grade environmental noise energy into a high grade energy able to induce electron excitations of specific biomolecules. Moreover, the quasi-free electrons of the water CD have a high probability of tunnelling out of the CD, making the CD the reducing element of the pair, whose other extreme is the non coherent phase, whose components can receive these electrons. The pair coherent water - non coherent water can thus produce a sizable redox potential. This opens an interesting perspective to biology.