Self-organizing systems having the properties which are involved to clarify the mechanism of human intellection and can be also used to realize quantum computers

T.M.Makhviladze and M.E.Sarychev

Institute of Physics and Technology, Russian Academy of Sciences, Nakhimovskii Prospect, 34, Moscow,117258, Russia.

sarych@yandex.ru

According to the concept being developed by R. Penrose [1] one of the critical components of the mechanism of human mind activity is the stable macroscopic quantum coherence of different neuron structures. At the same time just this property is required for effective work of a qubit system of a real full-scale quantum computer [2]. However, as it turned out, that it is very difficult to satisfy this condition during the time required for practically important calculations. This circumstance, i.e. the problem of quantum decoherence of a sufficiently large qubit system, is the main barrier on the way to the quantum computer implementation.

In our work a new approach to the problem of forming a qubit network for quantum computers is developed and discussed. As it seems to us, it can be promising for solution of the problem pointed out. We propose to use some equilibrium systems which can go to the special state having the off-diagonal long-range order (i.e. macroscopic quantum coherence) at temperatures below a critical one. In particular, it is shown that the systems of two-level or many level atoms interacting, respectively, with the one mode or many mode irradiation in the resonator have the property like this. Another example considered in the worl is the displacement-type ferroelectrics in the cavity electromagnetic field interacting with the two level transitions arising in the crystal lattice cells due to ion tunneling through the intra-cell potential. The advantage of these systems, which takes place due yo them self-organization, is the suppression of the temperature influence and the influence of the direct dipole-dipole interaction (in the case of ferroelectrics) as the decoherence factors acting on the work quantum states of the qubits (atoms, ferroelectric molecules).

[1] R. Penrose, The road to reality. A complete guide to the physical universe. London: Jonatan Cape (2004).

[2] W.H. Zurek, Rev. Mod. Phys. **75**, 715 (2003).