# QUANTUM COSMOLOGY AND LIFE

Evgeny A. Novikov
University of California - San Diego, BioCircuits Institute, La Jolla, CA 92093 -0328; E-mail: enovikov@ucsd.edu

**Abstract**

In frame of the quantum modification of general relativity (Qmoger), supported by cosmic data (without fitting), a new physically distinguished scale is obtained. This scale indicate a mechanism of formation new particles from the background matter. At the same time that scale corresponds to the size of a living cell.

Key words: quantum cosmology, scaling, living cell, qualia.

In the quantum modification of general relativity (Qmoger), in contrast with the conventional Big Bang theory, the matter (energy) is produced continuously by the vacuum. Qmoger equations [1-3] differ from the Einstein equations of general relativity by two additional terms, responsible for the production of matter. The simplest situation with production of matter is when averaged density of matter is constant: $\rho = \rho_0$. In Ref. 4 a more general situation is considered with $w = \rho c^2 + p = w_0$ ($w$ - density of enthalpy, $p$ - pressure, $c$ - speed of light). Taking into account, that averaged pressure is small, for many purposes the dust approximation ($p = 0$) is useful. In this case, the large-scale dynamics of the universe in Qmoger theory is determined by three physical parameters: gravitational constant $G$, $c$ and $\rho_0$. From these parameters we have unique scale:

$$L_* = \frac{c}{(G\rho_0)^{1/2}}, \tag{1}$$

That scale $L_* \approx 76$ billion light years ($bly$) [2, 3] is comparable with the current size of the visible universe $a_0 \approx 46.5\ bly$. Qmoger equations have corresponding exact analytical solution [5, 2, 3] for the evolution of the universe, quantitatively supported by cosmic data (without fitting).

During formation of galaxies, local density of matter becomes large. New particles are synthesized and, eventually, life cells are produced. In these processes, instead of gravitational constant, the Planck constant $\hbar$ becomes important. From $c$, $\hbar$ and $\rho_0$, we now have unique scale:

$$l_* = \left(\frac{\hbar}{c\rho_0}\right)^{1/4}. \tag{2}$$

We can rewrite (2) in the form:

$$l_* = \frac{\hbar}{cm_*},\ m_* = \rho_0 l_*^3. \tag{3}$$

So, scale $l_*$ corresponds to Compton wavelength of a particle with mass of background matter occupying volume of size $l_*$. This can indicate a mechanism of formation new particles from background matter. At the same time, $l_* \sim 10^{-4} cm$ is comparable with the size of a living cell. This fits well in explanation of subjective experiences (qualia) in terms of interaction of background matter (in Qmoger theory) with the neuron system [6]. Indeed, background particles are ultralight (with mass $m_0 = \hbar(cL_*)^{-1} \approx 5 \cdot 10^{-67} gram$), have tiny electric dipole moment $d \sim 2 \cdot 10^{-72} gram^{1/2} cm^{5/2} \sec^{-1}$ and form quantum condensate even for high temperature [2, 3]. Action potentials of neurons [7] can manipulate with such particles, create traps and coherent patterns. The huge number of degrees of freedom, necessary for qualia, is supplied by the number of particles $N_* = m_*/m_0 \sim 10^{24}$. Besides qualia, some other mysteries of living cell could also be connected with the background quantum condensate in the Qmoger framework.

**References**


[1] E. A. Novikov, Vacuum response to cosmic stretching: accelerated universe and prevention of singularity arXiv:nlin/06080050.

[2] E. A. Novikov, Ultralight gravitons with tiny electric dipole moment are seeping from the vacuum, Modern Physics Letters A, **31**, No. 15, 1650092 (5 pages) (2016).

[3] E. A. Novikov, Quantum modification of general relativity, Electr. J. Theoretical Physics, **13**, No. 35, 79-90, (2016).

[4] E. A. Novikov, Isenthalpic processes in cosmology, astrophysics and at home (submitted for publication).

[5] S. G. Chefranov & E. A. Novikov, Hydrodynamical vacuum sources of dark matter self-generation without Big Bang, J. Exper. Theor. Phys., 111(5),731-743 (2010) [Zhur. Eksper. Theor. Fiz.,138(5), 830-843 (2010)]; arXiv:1012.0241v1 [gr-qc].

[6] E. A. Novikov, Gravicommunication, subjectivity and quantum entanglement, NeuroQuantology, v. 14, issue 4, 677-682 (2016).

[7] https://en.wikipedia.org/wiki/Action_potential.