

# Origin of the Electron Bubbles, Twisters and Unidentified Electron Objects in Liquid Helium

Sylwester Kornowski

**Abstract:** Here, applying the Scale-Symmetric Theory (SST), we calculated sizes and described mechanism of production of the electron bubbles and the quantized vortices/twisters in liquid helium. Calculated size of the electron bubbles is 2.1 nm whereas of the twisters is of the order of an angstrom (0.1 nm). The mechanism of trapping the electron bubbles by the tangles-bundles composed of the quantized twisters (they are the cores of the electron bubbles) is described also. SST leads as well to electron bubbles with smaller core (4 times smaller) which exist at very low temperatures and explode at larger pressure. Such objects are referred to as the unidentified electron objects. Obtained results are consistent or very close to experimental data.

## 1. Introduction

The General Relativity leads to the non-gravitating Higgs field composed of tachyons [1A]. On the other hand, the Scale-Symmetric Theory (SST) shows that the succeeding phase transitions of such Higgs field lead to the different scales of sizes [1A]. Due to the saturation of interactions via the Higgs field and due to the law of conservation of the half-integral spin that is obligatory for all scales, there consequently appear the superluminal binary systems of closed strings (entanglons) responsible for the quantum entanglement, stable neutrinos and luminal neutrino-antineutrino pairs which are the components of the luminal Einstein spacetime (it is the Planck scale), cores of baryons, and the cosmic structures (protoworlds) that evolution leads to the dark matter, dark energy and expanding universes [1A], [1B]. The non-gravitating tachyons have infinitesimal spin so all listed structures have internal helicity (helicities) which distinguishes particles from their antiparticles [1A]. During the inflation, the liquid-like inflation field (the non-gravitating superluminal Higgs field) transformed partially into the luminal Einstein spacetime [1A].

Due to the symmetrical decays of bosons on the equator of the core of baryons, there appears the atom-like structure of baryons described by the Titius-Bode orbits for the nuclear strong interactions [1A].

The two first phase transitions are associated with the Higgs mechanism that leads from the superluminal non-gravitating Higgs field to the Principle of Equivalence.

Here, we show that the origin of the electron bubbles and the quantum vortices/twisters in liquid helium follows from the structure of protons and electrons described within the Scale-Symmetric Theory.

The size of the electron bubbles (in approximation 2 nm) is much too small to be photographed. We can increase the radius applying acoustic pulse. At first, the pulse creates lowered pressure and next increased. At first, the size reaches a maximum of about 10  $\mu\text{m}$  and next contracts to its initial size. The spheres in size about 10  $\mu\text{m}$  can be photographed.

## 2. Calculations

Within SST we described how in atoms is produced electric well/bubble [1A]. We as well described the Mexican-hat mechanism that leads to the confinement of neutrinos and neutrino-antineutrino pairs – there as well appears a well [1A]. Electrons produce such bubbles/wells also.

Calculate the sizes of the radiation-mass bubbles produced by proton and electron.

Due to the four-fermion symmetry, the charged core of proton (its mass is  $M_{\text{core-of-proton}} = 727.4401$  MeV whereas external radius is  $A = 0.6974425$  fm) simultaneously produces two virtual electron-positron pairs [1A]. The radiation mass of the two pairs is  $m_{r(\text{two-pairs})} = 4(m_{\text{electron}} - m_{\text{bare-electron}}) = 0.0023676$  MeV, where  $m_{\text{electron}} = 0.5109989$  MeV, whereas  $m_{\text{bare-electron}} = 0.510407$  MeV [1A]. Range of a gluon loop produced on equator of the core of proton is  $2\pi A$ . On the other hand, range of a particle is inversely proportional to its mass. This leads to conclusion that range of radiation mass of a proton we can calculate from following formula

$$R_{\text{bubble}(\text{proton})} = 2 \pi M_{\text{core-of-proton}} A / m_{r(\text{two-pairs})} \approx 1.35 \cdot 10^{-9} \text{ m} = 1.35 \text{ nm}. \quad (1)$$

We can see that around proton is created a radiation-mass bubble that size is 2.7 nm.

Calculate now size of the radiation-mass bubble for an electron (for the electron bubble). An electron produces simultaneously one virtual electron-positron pair [1A]. By an analogy to formula (1), we can calculate radius of the electron bubble from following formula

$$R_{\text{bubble}(\text{electron})} = 2 \pi m_{\text{bare-electron}} \lambda_{\text{bare-electron}} / m_{r(\text{one-pair})} = 1.05 \cdot 10^{-9} \text{ m} = 1.05 \text{ nm}, \quad (2)$$

where  $\lambda_{\text{bare-electron}} = 3.8661 \cdot 10^{-13}$  m is the reduced Compton length of the bare electron [1A].

We can see that size of the electron bubble is  $2R_{\text{bubble}(\text{electron})} = 2.1$  nm. The obtained result is very close to experimental data [2].

According to SST, loops can be composed of entangled neutrino-antineutrino pairs. They have internal helicity so they are the quantum twisters. Just the spins of the Einstein-spacetime components rotate in planes perpendicular to the loop so it has internal helicity. Probability of creation of the loops/twisters in stable states is highest. Since radius of the first Bohr orbit in hydrogen atom is about  $0.529 \cdot 10^{-10}$  m so size of such twister is in approximation 0.1 nm. Size of a tangle/bundle composed of such twisters should be of the order of an angstrom (0.1 nm). Mass of the loops is directly proportional to their radius [1D]. It leads to conclusion that smaller tangles/bundles are more stable (it results from following formula:  $M c^2 T_{\text{lifetime}} = \hbar$ ) i.e. they should explode at larger pressures. We can see that during a contraction of a vortex, we should observe a vortex multiplication – it follows from the fact that mass of a vortex is directly proportional to its radius.

Size of a twister produced in the ground state in liquid helium is  $0.025 \text{ nm} = 0.1 / 4 \text{ nm}$ , whereas for the shell  $n = 2$  and  $l = 0$ , we obtain  $0.1 \text{ nm}$  i.e. the same as for the ground state in hydrogen atom. The last result is consistent with the data at nonzero temperatures presented here [3].

The electron bubbles with the cores 4 times smaller (i.e. for the ground state of liquid helium, i.e. at very low temperature of liquid helium), we identify as the unidentified electron objects. We motivated that such objects are more stable so they should explode at larger pressures.

Centre of the bare electron [1A] (it is the centre of the electron bubble as well) can overlaps with a point of a twister so they can be entangled and/or confined – it is because electrons and twisters are built of the Einstein-spacetime components. We can see that electron bubble can be trapped by a vortex/twister so by a tangle/bundle of twisters as well.

### 3. Summary

Here, applying the Scale-Symmetric Theory (SST), we calculated sizes and described mechanism of production of the electron bubbles and the quantized vortices/twisters in liquid helium. Calculated size of the electron bubbles is  $2.1 \text{ nm}$  whereas of the twisters is of the order of an angstrom ( $0.1 \text{ nm}$ ). The mechanism of trapping the electron bubbles by the tangles-bundles composed of the quantized twisters (they are the cores of the electron bubbles) is described also. SST leads as well to electron bubbles with smaller core (4 times smaller) which exist at very low temperatures and explode at larger pressure. Such objects are referred to as the unidentified electron objects.

Obtained results are consistent or very close to experimental data.

Smaller twisters live longer i.e. are more stable. The unidentified electron objects have smaller core so they should live longer i.e. they should explode at larger pressures. Lifetime of the electron bubbles without core composed of twisters should be shortest.

### References

- [1] Sylwester Kornowski (2015). *Scale-Symmetric Theory*  
 [1A]: <http://vixra.org/abs/1511.0188> (Particle Physics)  
 [1B]: <http://vixra.org/abs/1511.0223> (Cosmology)  
 [1C]: <http://vixra.org/abs/1511.0284> (Chaos Theory)  
 [1D]: <http://vixra.org/abs/1512.0020> (Reformulated QCD)
- [2] J. Classen, C.-K. Su, M. Mohazzab, and H. J. Maris, *Phys. Rev. B* **57**, 3000 (1998)
- [3] Natalia G. Berloff, Marc Brachet, and Nick P. Proukakis (24 March 2014). “Modeling quantum fluid dynamics at nonzero temperatures”  
*Proceedings of the National Academy of Sciences (PNAS)*;  
[www.pnas.org/cgi/doi/10.1073/pnas.1312549111](http://www.pnas.org/cgi/doi/10.1073/pnas.1312549111)