

The Superluminal Interpretation of Quantum Mechanics

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Abstract: Here, within the Scale-Symmetric Physics (S-SP), we present a new interpretation of the Quantum Mechanics i.e. the superluminal interpretation (SIQM). Werner Heisenberg used term “the ideological superstructures” to the hidden-variables theory. All known mainstream interpretations of quantum mechanics deserve such a term. It follows from the fact that all mainstream interpretations neglect physical consistency of the 3-dimensional wave functions. A wave function which fills up the Universe cannot be a coherent physical object when distant points of the wave function cannot communicate with superluminal speed. Just period of a local change in the wave function (due to a luminal Standard-Model interaction) cannot be shorter than size of the wave function divided by superluminal speed. The Planck length is the lower limit for size of gravitating particles. Objects with sizes smaller than the Planck length must be non-gravitating so non-relativistic and they must be superluminal. The S-SP, due to the succeeding phase transitions, leads from the objects with sizes smaller than the Planck length (so superluminal) to objects with sizes close to the Planck length (so luminal) and larger. The question is not whether there are in existence some superluminal entanglons responsible for quantum entanglement but why we cannot see their motion directly. And the answer is very simple - just they are not the Standard-Model objects, their size is much smaller than the Planck length and the degree of filling of spacetime is very low.

Here, within the Scale-Symmetric Physics (S-SP), [1], we present a new interpretation of the Quantum Mechanics i.e. the superluminal interpretation (SIQM). More details concerning the quantum mechanics in the S-SP we can find in following papers [1] – [10].

Werner Heisenberg used term “the ideological superstructures” to the hidden-variables theory. All known interpretations of quantum mechanics deserve such a term. It follows from the fact that all mainstream interpretations neglect physical consistency of the 3-dimensional wave functions. A wave function which fills up the Universe cannot be a coherent physical object when distant points of the wave function cannot communicate with superluminal speed. Just period of a local change in the wave function (due to a luminal Standard-Model interaction) cannot be shorter than size of the wave function divided by superluminal speed. The shortest luminal lifetimes are about 10^{-25} s whereas the present-day size of the Universe is about 10^{26} m – it leads to conclusion that there must be in existence a fifth interaction with speed of interaction higher than about 10^{51} m/s. Only then the quantum mechanics can be

physically a coherent theory. Emphasize once more that we must show why lifetime of the local changes in a wave function is shorter than the time of communication between the outermost points of it. Since quantum mechanics is non-local so there must be in existence some superluminal entanglons responsible for the quantum entanglement.

The question is not whether there are in existence some superluminal entanglons responsible for quantum entanglement but why we cannot see their motion directly.

And the answer is very simple. The Planck length is the lower limit for size of gravitating particles. Objects with sizes smaller than the Planck length must be non-gravitating so non-relativistic and they must be superluminal.

The Scale-Symmetric Physics (S-SP), [1], is based on the succeeding phase transitions of the Higgs field composed of the non-gravitating superluminal pieces of space. Their size is about 10^{-64} m. During the inflation, some of them transformed into the superluminal entanglons responsible for the quantum entanglement (their speed is about 10^{68} m/s, size is about 10^{-45} m and they carry the non-gravitating unitary spin). We can see that sizes of the pieces of space and entanglons are smaller than the Planck length so they are the superluminal objects. We can see as well that the speed of entanglons (about 10^{68} m/s) is much higher than the calculated threshold (about 10^{51} m/s) so in S-SP the wavefunctions are the physically coherent objects. Entanglons are not the Standard-Model objects, their size is much smaller than the Planck length and the degree of filling of spacetime is very low so we cannot see their motion directly (CFD: yes).

In the Einstein General Theory of Relativity we apply formula for the total energy E of the Standard-Model particles in which mass M is for inertial mass equal to gravitational mass. Assume that the word 'imaginary' concerns physical quantities characteristic for objects that have broken contact with the wave function that describes state of the Universe. This means that such objects cannot emit some particles. Assume that the pieces of space are the internally structureless objects so they cannot emit some objects. From this follows that the pieces of space have only the inertial mass m . Substitute $i c$ instead c , $i v$ instead v and $i m$ instead M , where $i = \sqrt{-1}$. Then the formula for the total energy E of a gas composed of the pieces of space is:

$$E = M c^2 / \sqrt{1 - v^2 / c^2} = - i m c^2 / \sqrt{1 - v^2 / c^2} = m c^2 / \sqrt{v^2 / c^2 - 1}. \quad (1)$$

We can see that now the pieces of space must be superluminal.

The luminal gravitating neutrinos appeared during the inflation as well and are built of the entanglons. The luminal Einstein-spacetime components are the neutrino-antineutrino pairs and they can be free or entangled (then between them are exchanged the superluminal entanglons). It causes that the quantum mechanics which follows from the S-SP is the coherent theory.

More detailed considerations shows that the superluminal interpretation of Quantum Mechanics (SIQM) is non-deterministic, the wavefunctions are real, history is unique, there are not hidden variables, wavefunctions can collapse, observers are not needed, on assumption that the speed of light is the upper limit the theory is non-local, there are in existence objects which cannot be observed directly i.e. the superluminal pieces of space and entanglons (counterfactual definiteness (CFD): yes), and universal wavefunction does not exist because there are the non-quantum objects.

Notice that to the same conclusions appear in the transactional interpretation of quantum mechanics (TIQM) formulated by John G. Cramer in 1986 but the lack of the superluminal entanglons causes that this theory is physically incoherent.

To send superluminal information between entangled particles, at first we must separate them with luminal or subluminal speed.

The superluminal entanglements are as well the dark photons which entangle the dark matter particles and which entangle the visible matter with dark matter.

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