Proof of the incompleteness of wave quantum mechanics

First part.

Dzhomirzoev S.E.

The first paragraph shows fhe incompleteness of the formulas proposed by de Broglie for the corpuscular-wave duality (CWD) of a nonrelativistic electron (NE) and in the second paragraph the full CWD of a NE is shown and the deducibility of corpuscular and wave quantities from more general quantities is indicated. .

1. On the incompleteness of the formulas proposed by de Broglie for the CWD of a NE.

Historically, after the discovery of Plank's constant[1]:

$$\hbar = 1{,}054 \cdot 10^{-54} \text{дж•с} \tag{1.1}$$

Based on (1.1) , Einstein [2] proposed the following formulas for the momentum um and energi of the photon :

$$P = \hbar k \tag{1.2}$$

$$E = mc^2 \tag{1.3}$$

$$E = \hbar w \tag{1.4}$$

where, k – wave vector, m – relativistic mass, c – speed, w – cyclic frequency of the photon.

According to Einsten's formulas (1.2), (1.3), (1.4) the photon out to be a particle, which simultaneously has both corpuscular and wave quantities, that is, Einstein's formulas (1.2), (1.3), (1.4) turned out to be formulas for the CWD of the photon.

Subsequently, de Broglie [3] proposed a hypothesis about the inherent nature of CWD not only to the photon, but also to other particles. In particular, for the case of a NE de Broglie generalized the formulas for the CWD of the photon (1.2), (1.3), (1.4) as:

$$P = \hbar k \tag{1.5}$$

$$Ek = \frac{m v^2}{2} \tag{1.6}$$

$$E = \hbar w \tag{1.7}$$

where: k– wave vector, m-mass, v - speed, w – cyclic frequency NE.

In turn, Schrödinger [3] expressed the formulas CWD of the NE (1.5), (1.6), (1.7) using the differential operator $-i\nabla$:

$$k=-i\nabla \tag{1.8}$$

received the initial relations of wave quantum mechanics(WQM) in the form:

$$\hat{P}=i\hbar\nabla \tag{1.9}$$

$$\hat{E}_k=\frac{\hbar^2}{2m}\Delta \tag{1.10}$$

$$\hat{U}=i\hbar\frac{\partial}{\partial t} \tag{1.11}$$

where: $\hat{P}$, $\hat{E},\hat{U}$ — momentum and energi operators NE .

Now, let us point out the incompleteness of the formulas proposed by de Broglie for the CWD for the NE (1.5), (1.6), (1.7). The commonality of the formulas for the CWD of the hoton(1.2), (1.3), (1.4) with the formulas for the CWD for the NE (1.5), (1.6), (1.7) is that they characterize the photon and the NE in a state of motion when their velocities are different from zero. But unlike the photon, theNE considered de Broglie can have zero speed:

$$\boldsymbol{v} = 0 \tag{1.12}$$

Due to the fact that under condition (1.12) the formulas by de Broglie (1.5), (1.6), (1.7) be equal to zero, and thereforeit turns out that among them there is no formula la that characterizes a NE under condition (1.12). This is precisely why the formulas for the CWD of the NE (1.5), (1.6), (1.7) proposed by de Broglie turn out to be incomplete.

In this regard, in the second paragraph we will show the full form of the formulas for the CWD of the NE.

2. About the full form of the formulas for the CWD of the NE, as well as about the connection of corpuscular and quantities with corpuscular-wave quantities (CWQ).

First let us note the corpuscular quantities of a NE:

Mass: m (2.1)

Momentum: $P=m\cdot v$
(2.2)

Kinetic energi: $E_{\square}=\frac{mv^2}{2}$ (2.3)

Potential energi: $U=m\cdot v^2$ (2.4)

And the wave magnitude of the NE will be the linear wavelength of the NE:

$$ir=i=(1,2,3,4,0) \qquad (2.5)$$

where: 1,2,3,4,0 symbols of the five dimensions of the five-dimensional Klein-Gordon space:

$$R^2_{1,2,3,4,0}=¿ \qquad (2.6)$$

According to the CWD of the NE, each of the particle quantities of the NE (2.1)...(2.4) must be associated with a wave quantity, namely , with the linear wavelength of the NE (2.5) and represent the CWQ of the NE:

$$m^{¿}=mir \qquad (2.7)$$

$$P^{¿}=\hbar=(m^{¿}v)=m(irv) \qquad (2.8)$$

$$E^{¿}_{\square}=¿\ (\boldsymbol{m}^{*}v^{2})/2 \qquad (2.9)$$

$$U^{¿}=m^{*}v^{2} \qquad (2.10)$$

At the same time, the CWQ of the NE (2.7)...(2.10) that we obtained are the full form of the formulas for CWD of the NE, where the CWQ (2.7) corresponds to condition (1.12).

Here it is easy to notice that the formulas we obtained for the CWD of a NE (2.7)...(2.10) are superior to the formulas proposed by de Broglie for thout CWD of a NE (1.5), (1.6), (1.7) by symbols of the linear wavelength of a NE (2.5). Therefore, it is necessary to find out what in reality is the connection between the obtained CWD of a NE (2.7)...(2.10) and the formulas(1.5), (1.6), (1.7) proposed by de Broglie. Pursuing thir goal, we first transform CWQ of the NE (2.7)...(2.10) using the differential operator (1.8):

$$m^{¿}k\rightarrow(m^{¿}(-i\nabla))=m(ir(-i\nabla))=m \qquad (2.11)$$

$$\hbar k\rightarrow i\hbar\nabla=¿ \qquad (2.12)$$

$$¿ \qquad (2.13)$$

$$(U¿¿¿k)\rightarrow(U'(-i\nabla))=U_{1.2.3}-¿¿ \qquad (2.14)$$

где:

$$(ir(-i\nabla))=1 \qquad (2.15)$$

$$(v(-i\nabla))=-iw \qquad (2.16)$$

Now, it is easy to notice that both the formulas (1.5), (1.6), (1.7) proposed by de Broglie and initial relations of WQM (1.9), (1.10), (1.11) proposed by Schrödinger arise from transformations (2.11)...(2.14), if transformations (2.11)...(2.14) are presented relative to the corpuscular quantities of a NE (2.1)…(2.4):

$$m=m^{¿}k\rightarrow\hat{m}=-im^{¿}\nabla \qquad (2.17)$$

$$P=\hbar k\rightarrow\hat{P}=-i\hbar\nabla \qquad (2.18)$$

$$E_k=E_k^{¿}k\rightarrow\widehat{E_k}=-iE^{¿}\nabla \qquad (2.19)$$

$$U_{\square}=U^{¿}k\rightarrow\hat{U}=-iU^{¿}\nabla \qquad (2.20)$$

where, relations (2.17)...(2.20) are simplified forms of transformations (2.11)..(2.14) , since they take into account only corpuscular quantities corresponding to the three-dimensional dimension of the five-dimensional Kleim-Gordon space (1.6).

The representation of expressions (2.17)…(2.20) by de Broglie and Schrödinger in relation to the corpuscular quantities of e NE (2.1)...(2.4) is explained by the fact that thanks to Newton’s classical (corpuscular) mechanics, corpuscular quantities were known as previously known data.

Moreover, according to transformations (2.11)…(2.14), corpuscular quantities, with which all physics begins tanks to Newton’s classical mechanics, are in fact not the initial characteristics of objects of Nature, but, along with mixed and wave quantities, arise from corpuscular-wave quantities (2.7)…(2.10) after transformations (2.11)…(2.14) as spatially interrelated quantities.

It should also be noted that if we take into account the own radius vector of the NE $r\perp$, then between the values (2.7) and (2.8) the own moment of the NE will appear, which if the own spin:

$$m_{\perp}^{¿}=[m_{\square}^{¿}\times r_{\perp}]=m[ir\times r_{\perp}] \qquad (2.21)$$

Then, according to (2.21), the proper spin of the NE is generated by thea CWD of the NE (2.7). Accordingly, according to (2.21),for particles with a rest mass, their own spin is always different from zero, and for particles without a rest mass, their own spin is always zero, like a photon.

The fact of the existence in Nature of CWQ of a NE (2.7)…(2.10) leads to the emergence of Heisenberg uncertainties [5], since, due to the existence of CWQ of a NE (2.7)...(2.10), and a change in the wave magnitude of a NE (2.7) leads to a change in corpuscular quantities NE (2.1)...(2.4) and vice versa.

The appearance of the fundamental constant-Plank's constant (1.1) as an eigenvalue of microparticles should not be surprised, since another fundamental constant, the electric charge, also appears as an eigenvalue of microparticles.

Due to the fact that the CWQ of the NE (2.7)...(2.10) were not known to this day, and therefore, in the second part of this work we will indicate the connections between the CWQ of the NE (2.7)...(2.10) with the equation of motion of WQM.

Literature:

1. M. Planck, Ann. Phys., 1900, t. 63.
2. A. Einstein, Ann. Phys., 1905, t. 17, 149.
3. A. de Broglie, Ann. Phys., 1923, t. 3, 22.
4. E. Schrödinger, Ann. Phys., 1926, t. 79, 361, 489, 734.
5. W. Geisenberg, O. Kramers., Zc. Phys., 1925, t. 31.681.

Contact:

Email: djomirzoev501@yandex.ru
Tel: + (992) 901-11-22-32, WhatsApp.