De Broglie Hypothesis and the Schrödinger Equation: Gross Errors in Mathematics, Physics, Formal Logic and Dialectics

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Abstract

The irrefutable proof of the incorrectness of the de Broglie hypothesis (postulate) and the Schrödinger equation (postulate) is proposed. The correct methodological basis for the proof is the unity of formal logic and rational dialectics. The unity of formal logic and rational dialectics is the only correct criterion of truth. The proof leads to the following irrefutable conclusion: the de Broglie hypothesis (idea, postulate) and the Schrödinger equation (idea, postulate) are gross errors in mathematics, physics, formal logic and dialectics. This conclusion is based on the following statements: (1) from the point of view of Euler›s formula and the Maclaurin series, the definition of the wave function has neither physical nor mathematical meaning; (2) the substitution of the quantities of energy and momentum, which characterize a quantum (microscopic) particle, into the relationship that describes a macroscopic radiation wave is a gross formal-logical error, because a quantum particle and macroscopic radiation are not identical material objects; (3) in the dialectical and formal-logical points of view, a free classical particle is not identical to a free quantum particle: these particles are non-identical material objects. Therefore, the substitution of the quantities of energy and momentum, characterizing a quantum (microscopic) particle, into the classical relationship that describes the energy and momentum of a classical particle is a gross formal-logical error; (4) in the point of view of formal logic, the concepts of "corpuscular aspect" and "wave aspect" are contradictory (mutually exclusive) concepts. (The concepts of "particle" and "wave" are defined by different essential features of material objects). Therefore, the de Broglie wave function and the Schrödinger wave equation represent a violation of the formal-logical law of lack (absence) of contradiction. This means that the concept of corpuscular-wave dualism is erroneous; (5) The de Broglie wave function and the Schrödinger equation represent a gross dialectical error, because the dimensionless wave function contradicts to the dialectical concept of the measure of a material object (i.e. the dimensionless wave function does not have the qualitative determinacy of a material object, does not characterize the properties of a material object). Therefore, the de Broglie wave function and the Schrödinger equation are meaningless relationships.

1. Introduction

As is known, "the Schrödinger equation is a core of quantum mechanics. The Schrödinger equation is a linear partial differential equation that gives the evolution over time of a wave function (the form of the probability waves), the quantum-mechanical characterization of an isolated physical system. The equation was postulated by Erwin Schrödinger based on a postulate of Louis de Broglie that all matter has an associated matter wave. De Broglie won the Nobel Prize in Physics in 1929, after the wave-like behavior of matter was first experimentally demonstrated in 1927. Schrödinger won the Nobel Prize in Physics in 1933" (Wikipedia).

But, in my opinion, the Nobel Prizes are not proof of the correctness of the postulates (ideas) of de Broglie and Schrödinger, because the postulates (ideas) were not questioned within the framework of the correct methodological basis: the unity of formal logic and rational dialectics (see, for example, works [1-20]. Until now, scientists have not understood the fundamental importance of the correct methodological basis for the creation of correct theories. The purpose of this work is to propose

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an analysis of the postulates (ideas) of de Broglie and Schrödinger within the framework of the correct methodological basis of science: the unity of formal logic and rational (materialistic) dialectics. The unity of formal logic and rational dialectics is the only correct criterion of truth.

1.1 Standard Mathematical Basis for an Analysis of the Postulates

Euler formula and Maclaurin series as a mathematical basis for an analysis of the postulates are the following relationships:

$$e^{\alpha + i\beta} = e^{\alpha}\left(\cos \beta + i \sin \beta\right),$$

$$e^{\alpha - i\beta} = e^{\alpha}\left(\cos \beta - i \sin \beta\right),$$

$$e^{2\pi i} = 1, \quad e^{\alpha + i\beta} = e^{\alpha + i\beta + 2\pi i} = e^{\alpha + i\beta},$$

where

$$\cos \beta = 1 - \frac{1}{2!}\beta^2 + \frac{1}{4!}\beta^4 - \frac{1}{6!}\beta^6 + \dots,$$

$$\sin \beta = \beta - \frac{1}{3!}\beta^3 + \frac{1}{5!}\beta^5 - \frac{1}{7!}\beta^7 + \dots,$$

α and β are real numbers, $i = \sqrt{(-1)}$ is the imaginary unit.

1. 2 Plausible Reasoning that Leads to the Schrödinger Equation [17-20]

(a) Based on the well-known expression for the classical wave function of radiation, de Broglie proposed an analogy between the classical wave function of radiation and the wave function of an atomic (quantum) particle. The basis for this analogy was the fact that elastic scattering of a beam of atomic particles leads to a diffraction pattern. De Broglie's hypothesis (idea, postulate) is as follows.

As is known, if a classical plane radiation wave propagates along the scale x, then the classical radiation wave function can be represented in complex form:

$$\Psi(x, t) = A e^{-i(\omega t - kx)},$$

(where $\Psi(x, t)$ is the Classical wave function of radiation, $[\Psi(x, t)]$ = *no dim ention; x* and *t* are the coordinate and time, respectively, $[x]$ = *meter*, $[t]$ = *sec ond*; *A* is the amplitude of the wave (a dimensionless constant); $\omega = 2\pi\nu$ is the circular (cyclic) frequency of the radiation wave, $[\omega] = \frac{radian}{second}$; $\nu = \frac{1}{T}$ is the frequency, $[\nu]$ = *hertz*, ($Hz = s^{-1}$), *T* is the period, $[T]$ = *sec ond*; $k = \frac{2\pi}{\lambda}$, *k* is the wave number, λ is the wavelength of the radiation, $[\lambda]$ = *meter*, $i = \sqrt{(-1)}$ is the imaginary unit.

An essential feature of the classical wave function of radiation is that the right side of the relationship characterizes a material object, i.e. contains denominate quantities (concrete, named quantities), while the left side of the relationship (i.e. $\Psi(x, t)$) does not characterize a material object (i.e. is not a denominate quantities (concrete, named quantities)). In the de Broglie heuristic point of view, the hypothesis (idea, postulate) is that a free material quantum particle characterized by energy *E* and momentum *p* and moving along the scale *x* can be described by the following de Broglie wave function:

$$\Psi(x, t) = A e^{-(i/\hbar)(Et - px)}$$

where

$$h = 2\pi\hbar = 6{,}625 \cdot 10^{-34} \ joule \cdot \sec ond \ \text{ is Planck's constant;}$$

$$J = kg \cdot m^2 \cdot s^{-2}; \qquad [\hbar] = kg \cdot m^2 \cdot s^{-1}; \quad E = \hbar\omega, \qquad p = \hbar k, \qquad p = \frac{2\pi\hbar}{\lambda},$$

$$\lambda = \frac{2\pi\hbar}{p} = \frac{2\pi\hbar}{mv}, \qquad \left[\frac{\hbar^2}{m}\right] = kg \cdot m^4 \cdot s^{-2}, \qquad [E] = kg \cdot m^2 \cdot s^{-2}, \qquad [m] = kg,$$

$$[p] = kg \cdot m \cdot s^{-1}; \ \Psi^*\Psi = A e^{(i/\hbar)(Et - px)} \cdot A e^{-(i/\hbar)(Et - px)} = A^2.$$

De Broglie's hypothesis (idea, postulate) means that the classical wave function of radiation can turn into the wave function of a quantum particle.

An essential feature of de Broglie's hypothesis (idea, postulate) is the following:

A. the starting point of the de Broglie wave function is the well-known classical wave function of radiation;

B. the frequency of the radiation (i.e., $\omega_{(radiation)}$) is identical to the frequency of the quantum particle (i.e.,

C. the right side of the de Broglie function contains dimensional quantities $E = \hbar\omega$, $p = \hbar k$, $p =$
which characterize the material quantum particle; the left side of the function is a dimensionless quantity that does not characterize the material object.

D. According to Schrödinger's idea (postulate), one can differentiate the de Broglie wave function $\Psi(x, t) = Ae^{-(i/\hbar)(Et - px)}$) and obtain the following meaningless expressions:

$$\frac{\partial \Psi}{\partial t} = -\frac{i}{\hbar} E\Psi , \quad \frac{\partial^2 \Psi}{\partial x^2} = \left(\frac{i}{\hbar}\right)^2 p^2 \Psi ;$$

$$E = \frac{1}{\Psi} i\hbar \frac{\partial \Psi}{\partial t} , \quad p^2 = -\frac{1}{\Psi}\hbar^2 \frac{\partial^2 \Psi}{\partial x^2}$$

where $E = \hbar\omega$, $p = \hbar k$.

These relationships are meaningless because the wave function has no dimension:

$$\left[\frac{\partial \Psi}{\partial t}\right] = \frac{no\ dimention}{se\mathit{cond}} = nonsense ,$$

$$\left[\frac{\partial^2 \Psi}{\partial x^2}\right] = \frac{no\ dimention}{meter^2} = nonsense^2 .$$

In the heuristic point of view of Schrödinger, these expressions can lead to the differential equation of Schrödinger if one uses classical mechanics. Really, in classical mechanics, the energy E and momentum p of a free material particle are connected by the relationship

$$E = \frac{p^2}{2m} , \quad p = mv .$$

Then, in accordance with Schrödinger's idea (postulate), the substitution of meaningless quantum expressions

$$E = \frac{1}{\Psi} i\hbar \frac{\partial \Psi}{\partial t} , \quad p^2 = -\frac{1}{\Psi}\hbar^2 \frac{\partial^2 \Psi}{\partial x^2}$$

into the classical formula $E = \frac{p^2}{2m}$ leads to the following meaningless equation:

$$-\frac{\hbar^2}{2m}\frac{\partial^2 \Psi}{\partial x^2} = i\hbar\frac{\partial \Psi}{\partial t} .$$

$$\text{(where} \quad \left[\frac{\partial \Psi}{\partial t}\right] = \frac{no\ dimention}{se\mathit{cond}} = nonsense ,$$

$$\left[\frac{\partial^2 \Psi}{\partial x^2}\right] = \frac{no\ dimention}{meter^2} = nonsense^2)$$

which is a mixture of quantum and classical quantities characterizing a material particle. This equation is a special case of the Schrödinger wave equation.

In classical mechanics, in the case of a material particle moving in a force field characterized by potential energy V the relation between energy E and momentum p is the following:

$$E - V = \frac{p^2}{2m} , \quad \left[(E - V)\right] = kg \cdot m^2 \cdot s^{-2} .$$

In this case, the particular (special) form of the Schrödinger wave equation is the following:

$$-\frac{\hbar^2}{2m}\frac{\partial^2 \Psi}{\partial x^2} + V\Psi = i\hbar\frac{\partial \Psi}{\partial t}$$

This equation is also a mixture of quantum and classical quantities.

1. 3 Objections
The mathematical and physical essence of the wave function

$$\Psi(x,\,t) = Ae^{-(i/\hbar)\,(Et\,-\,px)})$$

can be understood if one uses the Euler formula and the Maclaurin series. Really, the application of the Euler formula and the Maclaurin series leads to the following expressions:

$$e^{-i\beta} \;=\; e^{-(i/\hbar)(Et-px)}, \;\; \beta \;=\; \frac{Et-px}{\hbar},$$

$$(\beta)^q \;=\; \left(\frac{Et-px}{\hbar}\right)^q, \;\; q = 1,\,2,\,3,\,\dots$$

If $q > 1$, then the relationship $(\beta)^q = \left(\frac{Et-px}{\hbar}\right)^q$ has no physical meaning because the degrees of energy E and momentum p have no physical meaning. In this case, the function $\Psi(x,\,t) = Ae^{-(i/\hbar)(Et\,-\,px)}$ represents a gross physical error.
Also, the expressions

$$\cos\beta \;=\; \cos\left(\frac{Et-px}{\hbar}\right), \;\; \sin\beta \;=\; \sin\left(\frac{Et-px}{\hbar}\right)$$

represent mathematical nonsense.

2. Substitution of quantum expressions

$$E \;=\; \frac{1}{\Psi}i\hbar\frac{\partial\Psi}{\partial t}, \;\;\; p^2 = -\frac{1}{\Psi}\hbar^2\frac{\partial^2\Psi}{\partial x^2}$$

where

$$\left[\frac{\partial\Psi}{\partial t}\right] = \frac{no\ dimention}{second} = nonsense\,,$$

$$\left[\frac{\partial^2\Psi}{\partial x^2}\right] = \frac{no\ dimention}{meter^2} = nonsense^2$$

into the classical formula $E = \frac{p^2}{2m}$ means (in accordance with the Schrödinger idea (postulate)) that a free classical particle, characterized by energy $E = \frac{p^2}{2m}$ and momentum $p = mv$, is identical to a quantum particle, characterized by energy $E = \hbar\omega$ and momentum $p = \hbar k$, i.e. a material particle is both a quantum particle and a classical particle. In other words, the Schrödinger idea (postulate) means the following logical identity relations: $\frac{p^2}{2m} = \hbar\omega$, $mv = \hbar k$.

But these identities are a violation of the formal-logical law of lack (absence) of contradiction. According to the law of lack (absence) of contradiction, $\frac{p^2}{2m} \neq \hbar\omega$, $mv \neq \hbar k$ because a particle cannot be both a classical particle and a quantum particle in given consideration (reasoning). Really, the concepts "classical particle" and "quantum particle" are defined by different essential features of particles. According to formal logic, the definition of a material particle and a mathematical equation must contain only one essential feature: either "classical object" or "quantum object". Consequently, Schrödinger's idea (postulate) is a gross formal-logical error.

3. Substitution of the quantities of energy $E = \hbar\omega$ and momentum $p = \hbar k$, characterizing a quantum (microscopic) particle, into the relationship that describes a macroscopic radiation wave is a gross formal-logical error of de Broglie, because a quantum particle and macroscopic radiation are not identical material objects. Really, the concepts "atomic particle" and "macroscopic radiation" are defined by different essential features of material objects. In accordance with formal logic, the definition of a material object must contain only one essential feature: either "macroscopic object" or "microscopic object". Consequently, de Broglie's idea (postulate) is a gross formal-logical error.

4. In the point of view of formal logic, the concepts "corpuscular aspect" and "wave aspect" are contradictory (mutually exclusive) concepts. (That is, the relations between these concepts is a relations of disagreement). The concepts "particle" and "wave" are defined by different essential features of material objects. According to formal logic, the definition of a material object must contain only one essential feature: either "particle" or "wave". Therefore, the de Broglie wave function and the

Schrödinger wave equation are a violation of the formal-logical law of lack (absence) of contradiction. This means that the concept of corpuscular-wave dualism is erroneous. Consequently, the ideas (postulates) of de Broglie and Schrödinger are gross formal-logical errors.

5. The well-known classical wave function of radiation – the starting point of de Broglie's hypothesis (idea, postulate) – is the gross dialectical error, because the dimensionless wave function of radiation contradicts to the dialectical concept of the measure of a material object (i.e. the dimensionless wave function of radiation does not have the qualitative determinacy of a material object). Therefore, the wave function of radiation has no physical meaning.

6. The de Broglie wave function and the Schrödinger equation are gross dialectical errors, because the dimensionless wave function contradicts to the dialectical concept of the measure of a material object (i.e., the dimensionless wave function does not have the qualitative determinacy of a material object). Therefore, the de Broglie wave function and the Schrödinger equation have no physical meaning.

7. Dimensionless quantities have no physical meaning because they do not characterize the properties of material objects. In other words, dimensionless quantities do not have qualitative determinacy and do not belong to material objects. Therefore, the concept of a dimensionless quantity contradicts to the dialectical concept of measure: measure is a category denoting the unity of qualitative determinacy and quantitative determinacy of a material object. Consequently, dimensionless quantities are meaningless quantities in science.

2. Discussion
Thus, the de Broglie hypothesis, the Schrödinger wave equation, and the concept of wave-particle duality represent gross errors in mathematics, physics, formal logic, and dialectics. The existence of gross errors in mathematics and physics was first proven in my works for example, [21-96]. The following question arises: Why did famous scientists make mistakes and continue to make mistakes? In my opinion, errors in science arise for the following reasons:

A. haste and immaturity of scientists in studying new phenomena;
B. the lack (absence) of the correct methodological basis and the criterion of truth in generally accepted science;
C. the unwillingness (disinclination, reluctance) of scientists to study the correct methodological basis and the criterion of truth: the unity of formal logic and rational dialectics;
D. the unwillingness (disinclination, reluctance) of scientists to question standard theories
E. the unwillingness (disinclination, reluctance) of scientists to think independently;
F. scientists worship the scientific authorities;
G. lack of tendency (yearning) to know the truth.

These reasons explain the modern crisis in science. Removing errors from modern science leads to the abolition of science. Errors in science are an inevitable consequence of the inductive path of cognition of the world. The inductive path does not lead to cognition of the Absolute Truth. The Absolute Truth is not granted to Humanity. Relative (partial) truths are a consequence of the Absolute Truth. The meaning of errors in science is as follows: (a) errors contain fragments of relative (partial) truths. This statement is a consequence of the existence of variety of objects and phenomena in the world; (b) errors as fantasies are a means of expansion of the consciousness of scientists. Expanded consciousness is the basis for technological (material) progress of humanity. (The atomic bomb would never have been created by scientists and technologists if scientists had worked within the correct methodological framework). The limit of technological progress is the self-extermination of humanity and the transformation of humanity into another form of beings in accordance with the dialectical law of negation of negation: "birth → development → destruction → new birth ...".

3. Conclusion
Thus, the correct methodological analysis of the de Broglie hypothesis (postulate) and the Schrödinger equation (postulate) leads to the following irrefutable conclusion: the de Broglie hypothesis (postulate) and the Schrödinger equation (postulate) are gross errors in mathematics, physics, formal logic, and dialectics. This conclusion is based on the following statements:
1. from the point of view of Euler's formula and the Maclaurin series, the definition of the wave function has neither physical nor mathematical meaning;
2. the substitution of the quantities of energy and momentum, which characterize a quantum (microscopic) particle, into the relationship that describes a macroscopic radiation wave is a gross formal-logical error, because a quantum particle and macroscopic radiation are not identical material objects;
3. in the dialectical and formal-logical points of view, a free classical particle is not identical to a free quantum particle: these particles are non-identical material objects. Substitution of the quantities of energy and momentum, characterizing a quantum (microscopic) particle, into the classical relation that describes the energy and momentum of a classical particle is a gross formal-logical error;

4. in the point of view of formal logic, the concepts "corpuscular aspect" and "wave aspect" are contradictory (mutually exclusive) concepts. (The concepts "particle" and "wave" are defined by different essential features of material objects). Therefore, the de Broglie wave function and the Schrödinger wave equation represent a violation of the formal-logical law of lack (absence) of contradiction. This means that the concept of corpuscular-wave dualism is erroneous;

5. the de Broglie wave function and the Schrödinger equation represent the gross dialectical error, because the dimensionless wave function contradicts to the dialectical concept of the measure of a material object (i.e. the dimensionless wave function does not have the qualitative determinacy of a material object, does not characterize the properties of a material object). Therefore, the de Broglie wave function and the Schrödinger equation are meaningless relationships.

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