# The antecedents and consequences of the combination of quantum and classical theory

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**Abstract**

The widespread quest to quantize gravity mirrors humanity's enduring drive to unify quantum and macroscopic physical frameworks. This research initiates its inquiry by integrating quantum mechanics with classical mechanics, yielding novel analytical perspectives, and introduces the Schrödinger-Tu equation—a wave function that incorporates gravitational potential energy and is capable of describing macroscopic objects. Validating the practical viability of merging quantum and classical approaches, several computational cases involving atoms and molecules yield successful outcomes. Additionally, this study derives a wave-mechanical formulation of classical mechanical laws, furnishing direct empirical evidence that quantum mechanics and classical mechanics are not mutually exclusive but rather compatible and complementary. Further substantiation of their compatibility encompasses the following key points:

1.The mass term $m$ in the Schrödinger equation (SE) can be scaled to sufficiently large values to characterize macroscopic entities;
2.The steady-state SE ($T\psi\ +V\psi=E\psi$) inherently integrates the wave function $\psi$ with the classical energy conservation relation $T+V=E$;
3.Potential energy functions within the SE can be derived from macroscopic force fields;
4.Newton's second law $F=ma$ and the SE are mutually derivable, establishing a fundamental theoretical linkage;
5.Electron diffraction experiments concurrently demonstrate wave-particle duality, a phenomenon that bridges both mechanical frameworks.
This paradigm shift—recasting the relationship between quantum and classical mechanics from one of incompatibility to compatibility—represents a pivotal theoretical advancement, with the potential to catalyze the development of a generalized wave mechanics.

**Keywords:** Quantum mechanics, Classical mechanics, General wave mechanics, Schrödinger-Tu equation, Wave mechanics equation with force

## Significance Statement

This article uses a complete chain of evidence to prove that quantum mechanics is compatible with classical mechanics and can be combined for use. This has changed the old notion that 'these two mechanics are incompatible'. Demonstrating the method of quantifying Newtonian mechanics can give people hope for the combination of quantum mechanics and macroscopic mechanics. By establishing the wave mechanics expression of classical mechanics laws, it is demonstrated that the organic combination between quantum mechanics and classical mechanics can form generalized wave mechanics. It can break the existing framework of quantum mechanics and is expected to promote the rapid development of physics. The combination of quantum and classical can lead to new computational methods in quantum mechanics.

## 1. Introduction

Quantum mechanics stands as one of the most successful scientific theories, underpinning technologies from computer chips to medical imaging machines. However, the theory's successful applications do not imply its completeness—particularly regarding the interpretation of quantum probability and non-realistic concepts that deny "original existence" (objective reality independent of measurement). Notable physicists including Einstein, Schrödinger, de Broglie, and Dirac expressed dissatisfaction with quantum mechanics' interpretation[1-13], and recent reports continue to highlight the need for improvement in the field [14-32].

The biggest highlight of this article is finding the source of the "logical problem of existing quantum explanations". By deriving the quantum mechanics equations of "classical mechanics laws", the existing framework of quantum mechanics has been shaken—quantum mechanics will become a "generalized wave mechanics" that is compatible with quantum and classical mechanics. However, the existing mathematical system of quantum mechanics is still an important component of "generalized wave mechanics". The main revision is the existing interpretation system of quantum mechanics. This article presents groundbreaking evidence demonstrating that quantum mechanics and classical mechanics are fundamentally compatible and can be combined for practical applications. More specifically,Our major contributions and Highlights include:

1) The Schrödinger-Tu Equation: We derive a Schrödinger equation incorporating gravitational potential energy that can describe macroscopic objects, extending quantum mechanics' applicability beyond the microscopic realm.

2) Mathematical Equivalence: We prove that Newton's second law (F=ma) and the Schrödinger equation are mutually derivable, establishing a fundamental theoretical bridge between classical and quantum mechanics.

3) Wave Mechanics Representation of Classical Laws: We develop a systematic method to express classical mechanical laws using wave mechanics formalism, demonstrating that classical mechanics can be seamlessly integrated into the quantum framework.

4) Experimental Validation: Our electron diffraction experiments demonstrate the strong robustness of de Broglie waves, challenging the conventional interpretations of wave function collapse and quantum decoherence.

5) General Wave Mechanics: By combining quantum and classical mechanics, we establish the theoretical foundation for "general wave mechanics"—a unified framework that describes both microscopic and macroscopic systems using wave mechanics methods.

6) Practical Applications: Multiple computational examples involving atoms and molecules demonstrate successful combinations of quantum and classical methods, proving the practical viability of this unified approach.

The mathematical foundation of quantum mechanics, particularly the Schrödinger equation, inherently combines the energy relationships from Newtonian mechanics with wave functions. This suggests that quantum mechanics' mathematical structure cannot logically exclude classical mechanical laws. By replacing electromagnetic potential energy with gravitational potential energy in the Schrödinger equation, we obtain an equation that applies to both microscopic and macroscopic planetary systems, demonstrating that the Schrödinger equation cannot establish a strict boundary between quantum and classical domains [14-31].

The shift from viewing quantum and classical mechanics as incompatible to recognizing their compatibility represents a significant conceptual change with profound implications. This paradigm shift enables the quantization of Newtonian gravity and opens new pathways for developing generalized wave mechanics. Our research demonstrates that the perceived "contradiction" between quantum and classical mechanics dissolves when we abandon interpretations that deny the original existence of microscopic particles. The theoretical framework established here not only resolves longstanding interpretational issues but also provides practical computational methods that combine the strengths of both mechanical frameworks [20,24].

Wave mechanics just is quantum mechanics.

## 2. Qualitative and quantitative relationships between de Broglie waves, waves of wave functions, and

**classical moving particles**

For describing the energy and momentum of moving particles, classical descriptions, de Broglie wave descriptions, and wave function descriptions must be able to find the same quantitative results (even if there are differences, they should not be sharp contradictions). Since it is a wave function, it should have its own noumenon (if there are no waves, how can there be a wave function). The 'wave of the wave function' refers to the essence of the wave function. Some people believe that the wave function is just a mathematical tool in quantum mechanics and has no practical significance (only the square of the wave function is meaningful). Some people believe that "waves of wave functions" are probability waves, similar to monochromatic electromagnetic waves. Advanced quantum mechanics theory states that the waves of the wave function are waves in configuration space, not waves in real space. Prior to this, we did not see any reports on the quantitative relationship between the wave and particle properties of moving particles.

The Schrödinger equation for a hydrogen atom is

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi+V\psi=E\psi. \qquad (1)$$

Replace the potential energy $V$ with $V=-\frac{GMm}{r}$, and Eq. (1) becomes

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi-\frac{GMm}{r}\psi=E\psi. \qquad (2)$$

From a purely mathematical perspective, Eq. (2) applies to both microscopic and macroscopic planetary model systems.. In the macroscopic planetary model system, uncertainty, quantum probability interpretation, and state superposition principle are not applicable, while $F=ma$ is applicable. Quantum mechanics who insist that $F=ma$ is not applicable in the microscopic world must deny the universality of Eq. (2) [at least deny its applicability in microscopic systems]. However, from a strict logical perspective, Eq. (2) itself cannot deny its applicability to both macroscopic and microscopic systems (*i.e.*, the Schrödinger equation cannot establish a watershed between macroscopic and microscopic systems).

The wave function used by Schrödinger is

$$\psi=\psi_0 e^{-\frac{i}{\hbar}(Et-\quad)}=\psi_0 e^{-i2\pi(\nu t-x/\lambda)}. \qquad (3)$$

Calculate the first term of Eq. (1) based on the two equivalent exponential functions on the left and right sides of the equal sign in Eq. (3). We can obtain $\frac{p^2}{2m}\psi=\frac{m\upsilon^2}{2}\psi=T\psi$ and $\frac{\hbar^2}{2m}(\frac{2\pi}{\lambda})^2\psi=\frac{(h\nu)^2}{2m\upsilon^2}\psi$, respectively. When using the exponential function on the left side of the equal sign in Eq. (3), we intentionally use classical mechanics laws. When using the exponential function on the right side of the equal sign, the relationship between $\lambda=h/m\upsilon$ and $\upsilon=\lambda\nu$ in the fluctuation law was employed. Since the equations $\frac{m\upsilon^2}{2}\psi$ and $\frac{(h\nu)^2}{2m\upsilon^2}\psi$ are derived from two completely equivalent wave function expressions and the same term in Eq. (1), the equation $\frac{m\upsilon^2}{2}=\frac{(h\nu)^2}{2m\upsilon^2}$ must hold, and the result is $(m\upsilon^2)^2=(h\nu)^2$. If the square roots are all positive, then, we have

$$\left.\begin{aligned} m\upsilon^2 &= h\nu \\ T &= \frac{1}{2}h\nu \end{aligned}\right\}. \qquad (4)$$

This indicates that in the two recognized energy representations implied in the Schrödinger equation for hydrogen atoms, kinetic energy is only half of the energy value represented by the wave law. At the same time, it indicates that the wave of the wave function (the noumenon of the wave function) is not consistent with the de Broglie wave.

The equivalence of $\frac{1}{2}\mathrm{m}\upsilon^2$ and $\frac{1}{2}h\nu$ can verify the phase velocity of de Broglie waves: $\upsilon=\frac{E}{p}=\frac{h\nu}{p}=\frac{m\upsilon^2}{m\upsilon}$. The relationship between phase velocity, wave energy, and momentum follows the universal law of waves, where $\upsilon=\lambda\nu$ and

$E=h\nu=mv^2$. Eq. (4) indicates that the wave energy described by the wave function is twice the kinetic energy of a moving particle or de Broglie wave. When calculating the energy of the described system based on the dynamic Schrödinger equation, it is easy to mistake the wave energy of the noumenon of the wave function as the energy of the described system. Actually, this merely indicates that the wave energy of the wave function chosen by quantum mechanics is not the kinetic energy of the moving particle.

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If the potential energy of a moving particle is zero, it is a free particle, and the Viry theorem no longer applies to it [one manifestation is that the sign of $E$ in Eq. (1) has changed]. Eq. (1) becomes $-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi = E\psi$. Except for the internal energy $mc^2$, the total energy of a moving particle is equal to its kinetic energy (considering energy conservation or the energy of the same particle, expressed by the wave law as $kh\nu$). The $kh\nu$ must be equal to $\frac{1}{2}mv^2$). So, we can obtain Eq. (4). The $E$ in $-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi = E\psi$ is $\frac{1}{2}h\nu$. If we use the partial derivative of the wave function over time $\frac{\partial}{\partial t}\psi$ to represent its operator, we need to make $f(i,\hbar)\frac{\partial}{\partial t}\psi = \frac{1}{2}h\nu\psi$. By solving this equation, we can obtain the relationship between $f(i,\hbar)=-\frac{i\hbar}{2}$ and $\hat{E}_k=\hat{T} = -\frac{i\hbar}{2}\frac{\partial}{\partial t}$. So, we have

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi = \frac{i\hbar}{2}\frac{\partial}{\partial t}\psi. \qquad (5)$$

This is the free particle wave equation (*i.e*., the wave equation for the de Broglie wave of a one-dimensional free particle). It is also derived from the Schrödinger equation of hydrogen atoms and is suitable for describing free particles (*i.e*., more suitable for de Broglie waves). To obtain partial derivatives in the free particle wave equation, Eq. (4) must be obtained [otherwise, one of Eqs. (4) and (5) must not hold]. Section 8: Derive the correct Schrödinger equation using the unitary operator of Hilbert space—Eq. (1).

Eq. (5) is also the wave mechanics equation of kinetic energy. The relationship between the energy of the de Broglie wave of a moving particle and the wave energy of the wave function is equivalent to another representation of Eq. (4). The mutual conversion between the dynamic Schrödinger equation and the steady-state Schrödinger equation applicable to planetary model systems can be achieved using Eq. (5) (as well as $E=-T$ or $p=mv$ and $v=\lambda\nu$).

As mentioned above, we have achieved a high degree of unity between the waves of de Broglie waves and wave functions. There is no fundamental contradiction between the classical mechanical description of moving particles and their descriptions of de Broglie waves and wave functions. For a moving particle, if described by classical mechanics, concepts such as mass point, mass, velocity, momentum $p=mv$, kinetic energy $T=(1/2)\,mv^2$, and Newton's laws of mechanics can be used; If we use the description of traveling waves, we can use concepts and expressions such as wavelength $\lambda=h/p$, momentum $p=mv$, wave velocity $v=\lambda\nu$, wave energy $E=mv^2$, kinetic energy $T=\frac{1}{2}mv^2$, etc; If described using a wave function, concepts and expressions such as wavelength $\lambda=h/p$, momentum $p=mv$, wave velocity $v=\lambda\nu$, wave energy $E=h\nu=mv^2$ can be used.

Refs. [14-20] indicate that the Schrödinger equation with gravitational potential energy can be established to describe macroscopic objects. Wave mechanics is no longer a patent of the microscopic world. In this case, if the goal referred to in the title of this section is further achieved, quantum mechanics and classical mechanics can share a set of physical axioms (theoretical postulates).

### 3. Discuss from the source that the position of NAspect experiment in quantum mechanics is not unbreakable

The explanatory system of quantum mechanics has always been perplexing [31]. The origin of the quantum mechanics interpretation system denies that microscopic particles have stable, independent, and complete eigenstates [referred to as denial of stable, independent, and complete eigenstates (DSICE)]. This idea originated from the explanation of the phenomenon of double slit diffraction experiment. The representative of the Copenhagen interpretation is the explanation of the Aspect experiment. These three explanations are connected into a progressive ladder: the explanation of the double slit diffraction experiment → denying that microscopic particles have complete, independent, and stable eigenstates → Copenhagen explanation and Aspect experiment explanation. Through careful analysis, it is not difficult to find that there is a logical loophole in the existing explanation of the double slit diffraction experiment—the viewpoint that "dark fringes are caused by wave interference" has not been verified, and there can be other explanations. The statement 'interference' can only be used if it is experimentally proven that particles have reached the dark areas without causing any photosensitive reaction.

After Yang's double slit experiment, Taylor conducted a single photon double slit diffraction experiment - allowing photons to pass through the double slit one by one (Taylor experiment). The result of the Taylor experiment is still the same as the Young's double slit experiment, with interference fringes appearing (see **Figure 1**). This is the belief that microscopic particles are not independent and mature entities。 The Copenhagen interpretation and Aspect experiment interpretation are both based on the DSICE interpretation. Some people have also found a mathematical logical basis for explaining DSICE: they have established the concepts of probability waves and probability amplitudes for microscopic particles in mathematics (which also adopts DSICE's viewpoint). However, the necessary experimental phenomenon for this explanation is that when one microscopic particle passes through a double slit, there should be a situation where "two bright spots" appear on the receiving screen. The reason is that we have determined that the dark fringe is the result of interference between two parts that appear simultaneously. In the area of the bright fringe, it should be that two parts of a particle do not meet and interfere (if the two parts did not meet, it could cause two photosensitive points). From another perspective, if only one bright spot is formed on the receiving screen every time a particle is emitted through a slit, it is highly likely that the particle passing through the double slit is in a stationary point particle or spherical particle state before and after passing through the slit, rather than a discrete probability wave state. For the results of the single particle double slit experiment, the interference fringes are the accumulation of points, proving that the interference fringes are not the probability amplitude superposition of discrete waves (the argument that discrete waves can only form small bright spots on the screen sounds awkward). In other words, although the dark fringes on the receiving screen are very similar to diffraction fringes, there are still two possibilities for the formation of dark fringes (shadow): first, the microscopic particles did not reach there; Secondly, the particles that arrived there interfered.

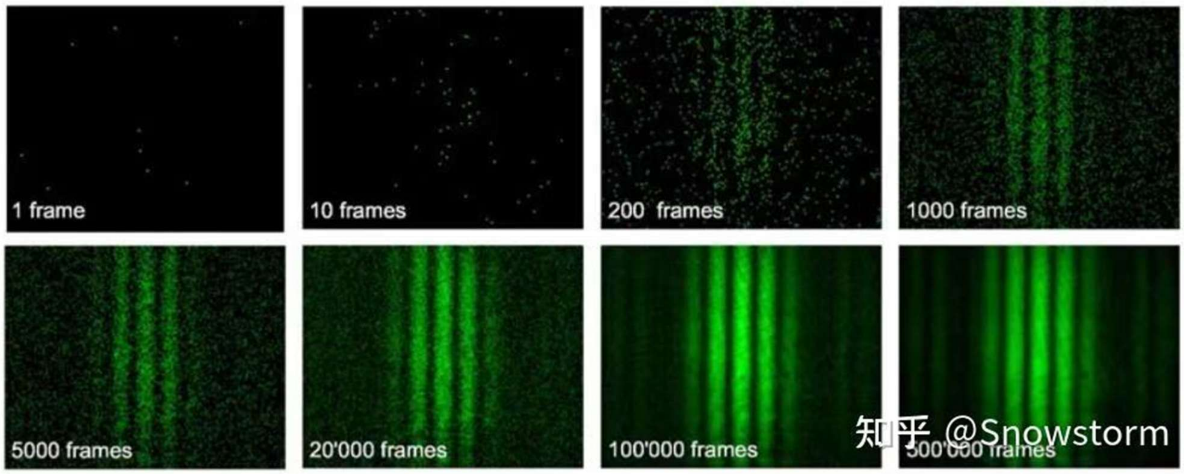


**Figure 1**. The photosensitive results of Taylor's single photon double slit diffraction experiment. It can be explained using Huygens' principle.

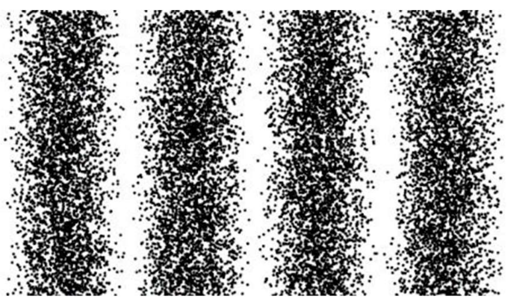

**Figure 2**. The photosensitive results of electrons passing through the double slit one by one. After a photon passes through the double slit, hitting the receiving screen is just a small bright spot. It is not convenient to explain it using the term 'discrete wave screen photosensitive reaction'.

Whether particles have reached the dark areas can be verified through experimental methods. One specific method is to manufacture a second-order diffractometer—that is, to cut a slit on a movable first-order receiving screen, and then install a second-order receiving screen behind it. The operation of the instrument is to allow some test particles to pass through the front and rear slits. After starting the instrument, locate the location of the dark fringes, move the slit on the primary receiving screen to a dark fringe, and observe the diffraction patterns on the secondary receiving screen. If particles reach the shadow on the primary receiving screen, secondary diffraction fringes will appear on the secondary receiving screen. Otherwise, it indicates that no particles have reached the dark stripes of the primary receiving screen. This type of second-order diffraction experiment is easy to implement. It would be a pity if we didn't do it.

The possible reason why particles that have already passed through the slit did not reach the dark stripe is that "the slit particles have direction quantization" [32]. There are atoms at the edge of the slit. These atoms (especially their nuclear charges) have an impact on the particles passing through the gap. The diffraction experiment of photons can be explained using Huygens' principle. For non photons, it is possible that particles pass over different main energy level regions of atoms, and the quantization of orbital angular momentum may have an impact on the passing particles.

As mentioned above, as long as the second-order diffraction experiment proves that no particles reach the dark fringes of the double slit diffraction pattern, it shakes the super position of the Aspect experiment in quantum mechanics. The mechanism of directional quantization can be gradually explored.

Finding the problem of aspect experiment explanation is equivalent to shaking the foundation of existing quantum mechanics explanations. The quantum mechanics equations derived from classical mechanics laws are equivalent to shaking the existing framework of quantum mechanics.

## 4. The wave equation of classical mechanics laws and universal operators of fundamental physical quantities

Quantum mechanics, also known as wave mechanics, and its mathematical foundation is wave equations. As long as the wave equation that can derive important classical laws of force mechanics can be derived, it is a key part of finding the mathematical foundation for a new theory that combines classical force mechanics and wave mechanics. Since it is the combination of classical mechanics and quantum mechanics, the original mathematical foundation and formal system of quantum mechanics can be preserved. The reason at people are dissatisfied with the existing quantum mechanics, mainly with the explanatory system of quantum mechanics. The contradictions with classical mechanics are also caused by existing interpretations of quantum mechanics. The key to the existing explanation system of quantum mechanics is the explanation of quantum probability and the explanation of "denying the original existence of microscopic systems" (which is also a non real explanation).

For planetary models, the relationship between potential energy and force $F$ is $F=V/r$. In the Bohr hydrogen atom model, the relationship between the kinetic energy of electrons in the planetary model and the energy E of electrons is $E=\frac{1}{2}V=-\frac{1}{2}mv^2=-\frac{1}{2}rF$.

Eqs. (32) and (40) introduce the derivation of the $T+V=E$ from the Schrödinger Eq. (1) for hydrogen atoms. In the classic planetary model, $E=-T$ in $T+V=E$. Both sides of this equation are divided by the orbital radius $r$ in the planetary model, and considering $F= V/r$, We can obtain the relationship between kinetic energy and force: $2T/r=F$. Substituting $T=mv^2/2$ into $2T/r=F$, and considering that the acceleration of an object in uniform circular motion is $a=v^2/r$, we can obtain $ma=F$.

The formula for kinetic energy in classical mechanics is $T=\frac{p^2}{2m}$. For an object in uniform circular motion, $2T/r=F$ can be written as $F=mv^2/r$. Multiplying both sides of $F=mv^2/r$ by $\frac{1}{2}r$, we can obtain $\frac{1}{2}Fr=\frac{1}{2}mv^2=T$. Substituting $\frac{1}{2}mv^2=T$ into Eq. (4) $\frac{1}{2}mv^2+V=E$, or $(1/2)mv^2+Fr=E$ 我们将$(1/2)mv^2+Fr=E$ 这个经典力学公式写为 we write the classical mechanical formula $(1/2)mv^2+Fr=E$ *as*

$$\frac{p^2}{2m}+V=E. \qquad (6)$$

If all terms of Eq. (6) are multiplied by $\psi$, we can obtain $\frac{p^2}{2m}\psi+V\psi=E\psi$.

The operator of force is also a wave mechanics representation of force (a method of calculating force using wave mechanics). Considering that $F=\mathrm{d}V/\mathrm{d}r=-\mathrm{d}p/\mathrm{d}t$, by dividing both sides of $F=ma$ by the interaction distance $r$, we can obtain $F=\frac{mv^2}{r}$ or $F=-\frac{Ze^2}{r^2}$.

For the uniform circular motion of electrons (行星模型), $pr=\frac{1}{2}\hbar$. Considering $p=mv$, and $F=V/r$, we can obtain

$$F=-2p^3/m\hbar. \qquad (7)$$

The operator of $p^3$ is

$$\hat{p}^3=i\hbar^3\frac{\partial^3}{\partial x^3}. \qquad (8)``$$

By replacing $p^3$ in Eq. (7) with the operator the operator represented by Eq. (8), we can obtain

$$\hat{F}=\frac{2i\hbar^2}{m}\frac{\partial^3}{\partial x^3}. \qquad (9)$$

Multiply both sides of $F=ma$ by $\psi$ to obtain the relationship between $F\psi=ma\psi$. Replace $F$ with the force operator shown in Eq. (8), and obtain the wave mechanics Eq. (10) for the final force. We can also directly write Eq. (10) based on Eq. (9).

$$\hat{F}\psi=2\frac{i\hbar^2}{m}\frac{\partial^3}{\partial x^3}\psi. \qquad (10)$$

In a bound state equilibrium system, the force acting on electrons conforms to this equation.

Considering $mv^2=2T$, substituting $r=\frac{4\pi\varepsilon_0\hbar^2}{mZe^2}$ into $F=-\frac{Ze^2}{r^2}$, we can obtain $\frac{TmZe^2}{2\pi\varepsilon_0\hbar^2}=F$. By replacing the kinetic energy $T$ with the kinetic energy operator $\hat{T}=-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}$, we can obtain

$$\hat{F}=-\frac{Ze^2}{4\pi\varepsilon_0}\frac{\partial^2}{\partial x^2}. \qquad (11)$$

Eqs. (11) and (9) are equivalent when $Z$=1, the operator of force and the wave equation containing force are completely new research results that were not available before.

The expression for the law of conservation of momentum is $m_1v_1=m_2v_2$, or $p_1=p_2$. Replace the momentum $p$ with the operator $\hat{p}=-i\hbar\frac{\partial}{\partial x}$, resulting in $\hat{p}_1=-\hbar\frac{\partial}{\partial x_1}$ and $\hat{p}_2=-i\hbar\frac{\partial}{\partial x_2}$. Multiplying both sides of this equation by both $\psi_1\times\psi_2$, we can obtain

$$-i\hbar\psi_2\frac{\partial}{\partial x_1}\psi_1=-i\hbar\psi_1\frac{\partial}{\partial x_2}\psi_2. \qquad (12)$$

Here, $\psi_1=A_1e^{-\frac{i}{\hbar}(E_1t_1-p_1x_1)}$, $\psi_2=A_2e^{-\frac{i}{\hbar}(E_2t_2-p_2x_2)}$, $E_1=h\nu_1$, $E_2=h\nu_2$. Eq. (12) is the law of conservation of momentum expressed using wave mechanics methods. It indicates that wave mechanics allow the law of conservation of momentum to apply.

Calculate the first term in Eq. (1) and move some terms to become $\frac{p^2}{2m}\psi-E\psi=-V\psi$. Considering $E=-T$, we have

$$-\frac{p^2}{m}\psi=V\psi. \qquad (13)$$

By replacing $p^2$ in Eq. (13) with an operator form, the potential energy operator $\hat{V}=\frac{\hbar^2}{m}\frac{\partial^2}{\partial x^2}$ can be obtained (note: potential energy $V$ is a negative value).

$$\frac{p^2}{mr}\psi=F\psi=\frac{p}{v}\frac{v^2}{r}\psi. \qquad (14)$$

By substituting $a=v^2/r$ into Eq. (14), we can obtain $F\psi=a[\frac{p}{v}]\psi$. By replacing the momentum $p$ with the operator $\hat{p}=-i\hbar\frac{\partial}{\partial x}$ and using the relationship of $v=c\alpha$ for the ground state Bohr hydrogen atom, we can obtain

$$\hat{F}\psi=-a\frac{i\hbar}{c\alpha}\frac{\partial}{\partial x}\psi. \qquad (15)$$

Eq. (15) is Newton's second law expressed using the wave mechanics method (applicable to Bohr's planetary model). According to the Schrödinger equation. It indicates that wave mechanics allows Newton's second law to apply under certain conditions.

Using $\lambda=h/mv=h/p$, $v=\lambda\nu$, $a=v^2/r$ and Eq. (4), the first equation in Eq. (14) can be transformed into a $a\left[\frac{p^2}{h\nu}\right]\psi=F\psi$.

Using Eq. (4), $a\left[\frac{p^2}{h\nu}\right]\psi = F\psi$ can be transformed into $a\left[\frac{p^2}{2T}\right]\psi = F\psi$. By replacing $p^2$ with the corresponding operator $\hat{p}^2 = -\hbar^2\frac{\partial^2}{\partial x^2}$, we can obtain

$$F\psi = -\frac{a\hbar^2}{2T}\frac{\partial^2}{\partial x^2}\psi. \qquad (16)$$

Eq. (16) is applicable to both macroscopic and microscopic planetary models, unlike Eq. (15) which is only applicable to ground state hydrogen atoms. From the derivation process of Eq. (16), it can be seen that the operator of the force with a wider range of applicability is $\hat{F} = -\frac{a\hbar^2}{2T}\frac{\partial^2}{\partial x^2}$.

From Eq. (16), it can be seen that the mass operator of a moving object is related to its kinetic energy

$$\hat{m} = -\frac{\hbar^2}{2T}\frac{\partial^2}{\partial x^2}. \qquad (17)$$

This operator is applicable to moving objects in bound state systems, such as Planetary Model System. According to Eqs. (15) and (16), $T+V=E$ can be transformed into a much more widely applicable form.

$$a\left[-\frac{\hbar^2}{4T}\frac{\partial^2}{\partial x^2}\right]\psi+\frac{E}{r}\psi = F\psi. \qquad (18)$$

However, the applicability of Eq. (18) is limited and only applies to planetary model systems where the Huang Weili law holds. According to $\hat{T} = -\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}$, $\hat{V}=\frac{\hbar^2}{m}\frac{\partial^2}{\partial x^2}$, $E=-T=-\frac{p^2}{2m}$, $\hat{E}=-\hat{T}=\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}=-i\frac{\hbar}{2}\frac{\partial}{\partial t}$ (the last equation can be found in Refs. 15-16), the wave mechanics expression of Viry's theorem can be obtained: $-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi + \frac{\hbar^2}{m}\frac{\partial^2}{\partial x^2}\psi=-i\frac{\hbar}{2}\frac{\partial}{\partial t}\psi$ or

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi + V\psi=-i\frac{\hbar}{2}\frac{\partial}{\partial t}\psi. \qquad (19)$$

The concise form of the classical expression for Viry's theorem is $V=-2T$. Considering $\hat{T} = -\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}$, we have $V\psi = \frac{\hbar^2}{m}\frac{\partial^2}{\partial x^2}\psi$.

According to the momentum operator $\hat{p} = -i\hbar\frac{\partial}{\partial x}$, the velocity operator, velocity squared operator, and acceleration operator can be obtained.

$$\hat{v}=\hat{\dot{r}}=-\frac{i\hbar}{m}\frac{\partial}{\partial x}, \qquad (20)$$

$$\hat{v}^2=-\frac{\hbar^2}{m^2}\frac{\partial^2}{\partial x^2}. \qquad (21)$$

$$\hat{a} = \hat{\dot{v}} = -\frac{\partial}{\partial t}\left[\frac{i\hbar}{m}\frac{\partial}{\partial x}\right]. \qquad (22)$$

The equation describing the motion of a particle is $s=vt$. Considering Eq. (20), $\hat{s} = -i\hbar\frac{t}{m}\frac{\partial}{\partial x}$ and $s = -i\hbar\frac{t}{m}\frac{\partial}{\partial x}\psi$. When we use Eq. (22), we must use the relationship of $p=mv$. Based on the derivative of the wave function of kinetic energy with respect to $t$, and considering $m=2T/v^2$, the quality operator is $\hat{m}=-i\hbar\frac{\partial}{\partial t} \div \left[-\frac{\hbar^2}{m^2}\frac{\partial^2}{\partial x^2}\right]$, that is

$$\hat{m} = i\frac{m^2}{\hbar}\left[\frac{\partial}{\partial t}/\frac{\partial^2}{\partial x^2}\right]. \qquad (23)$$

This quality operator is universal, while Eq. (17) only applies to systems where the "Viry theorem applies". If the operator forms of various physical quantities are written, then classical physics formulas have corresponding operator expressions, which can be written as wave mechanics equations. For example, the operator formula for Newton's second law of *F=ma* is $\hat{F}=m\hat{a}$. According to the multiplication operation of $m\hat{a}$, Eq. (24) can be obtained.

$$\hat{F}=-i\hbar\frac{\partial^2}{\partial t\partial x}. \qquad (24)$$

According to $F=\partial p/\partial t$ and $\hat{p}=-i\hbar\frac{\partial}{\partial x}$, Eq. (24) can also be obtained. Eq. (24) is applicable to planetary models and object in linear motion. Considering $F=mv^2/r$, Eqs. (21) and (24), the "wave mechanics equation with force" applicable to all planetary models is

$$F\psi=-i\hbar\frac{\partial^2}{\partial t\partial x}\psi. \qquad (25)$$

Eq. (24) is the wave-mechanical form of the universal Newton's second law, whch is universal.

Eq. (25) is the wave mechanics expression of Newton's second law and is universal and is universal. The wave mechanics representations of various classical mechanical concepts and laws can form a complete system. With such a system of mechanical equations, it can no longer be denied that classical mechanics can be combined with wave mechanics.

The above discussion has already covered the four operations of operators. Eq. (22) and $m\hat{a}$ involve multiplication of "heavy partial derivatives" or/and operators, while Eq. (23) involves division of operators. The multiplication rule of operators is reflected in Eq. (25) (belonging to the rule of multiple derivatives). Please note that the value of $\psi$ must be written in parentheses to indicate that $\frac{\partial}{\partial t}$ no longer directly acts on $\psi$. This is different from the high-order partial derivative rule. Especially the heavy partial derivatives with different independent variables. This is different from the high-order partial derivative rule. Especially for the heavy partial derivatives with different independent variables. The division rule of operators is to take the derivatives of the numerator and denominator separately, and then divide them. The relationship between Eqs. (20) and (21) reflects the operation rule of the square of the operator. As for the square root of operators, the situation is quite complex. The rules are left to mathematicians to formulate. This section has constituted a true wave mechanics that does not distinguish between "quantum" and "classical".

Using equation (3), we can obtain $\frac{p^2}{2m}\psi=-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi=T\psi$. For the electromagnetic potential energy function, $V=E/r$. We will first learn from Bohr and start by using the planetary model. Then transition to the Schrödinger method. In the planetary model of hydrogen atoms, the orbital angular momentum of electrons is $pvr=\hbar$. The orbital velocity of the first main layer electrons is $v=\alpha c$. Dividing all terms of Eq. (2) by the radius $r$, and considering the electron orbital angular momentum formula and orbital velocity formula here, we can obtain

$$-c\alpha\hbar\frac{\partial^2}{\partial x^2}\psi-\frac{E}{r}\psi=F\psi. \qquad (26)$$

Among them, α is the fine structure constant.

In Eq. (1), the relationship between $E$ and $V$ is $V=2E$. In this way, $E/r=V/2r$. The three-dimensional form of Eq. (6) is

$$-c\alpha\hbar\nabla^2\psi-\frac{V}{2r}\psi=F\psi. \qquad (27)$$

It is applicable to the 1s electron of hydrogen atom [See Eq. (24) in Section 6 for the shape applicable to all planetary models]. Due to the energy eigenvalue of hydrogen atoms being $E=-\frac{Ze^2}{2r}$, the equation becomes

$$-c\alpha\hbar\nabla^2\psi+\frac{Ze^2}{2r^2}\psi=F\psi. \qquad (28)$$

The establishment of Eq. (26) is like Bohr's successful use of old quantum theory to describe the hydrogen atom, which is a preliminary success in the effort to "give wings of force" to wave mechanics. It can intuitively demonstrate that wave mechanics itself does not exclude classical mechanics. Reference [32] introduces a more concise export method.

## 5. Exploring the physical mechanism and Condition of quantization, integrating Newtonian gravity into the framework of quantum mechanics

After deriving the wave equation containing force, finding its solution can yield the quantized force (the equations of wave mechanics with force allow "force" to be quantized). The force involved can be either Coulomb force or Newtonian gravity. This indicates that we have found a mathematical method that allows for the quantization of Newton's gravity. It is not difficult to see that the method we use is to give force to the 'quantum'. Prior to this article, the method used was to quantize "force", and it is a way to establish new theories. The research strategy of giving "force" to "quantum" is to consider the role of force in quantum mechanics (without the need to establish a completely new theoretical system). The quantization given by the Schrödinger equation is mathematically permissible quantization, which does not inform us about the physical factors determining quantization. We aim to explore the physical causes of quantization in this section.

Eq. (26) is a wave equation that first appeared in human vision and can calculate the forces between electrons and nuclei in atoms. Readers can first perform a simple verification: choose Eq. (3) for the wave function, then select an arbitrary value of $r$, and calculate the size of $F$ based on Eq. (26). If you have time, you can also solve Eq. (28), just like solving the Schrödinger equation for hydrogen atoms, to calculate the quantized forces in hydrogen atoms. If describing the Newtonian gravitational system, then $V=-G\frac{Mm}{2r}$. Eq. (27) can be written as

$$-\frac{i\hbar}{m}\frac{\partial^2}{\partial t\partial x}\psi-\frac{G}{2}\frac{Mm}{r^2}\psi=F\psi. \qquad (29)$$

The export method for the first term in the equation is as follows. According to Eq. (1), this term is $-\frac{\hbar^2}{2mr}\frac{\partial^2}{\partial x^2}\psi$. According to $mv^2/r=F$, it can be inferred that $r=mv^2/F$ . Replace $F$ with Eq. (29) $\hat{F}=-i\hbar\frac{\partial}{\partial t}\left[\frac{\partial}{\partial x}\right]$, and replace $v^2$ with $\hat{v}^2=-\frac{\hbar^2}{m^2}\frac{\partial^2}{\partial x^2}$. It can be concluded that $\hat{r}=-m\frac{\hbar^2}{m^2}\frac{\partial^2}{\partial x^2}\div\frac{\partial}{\partial t}\left[-i\hbar\frac{\partial}{\partial x}\right]$. Solving Eq. (26), we can obtain the quantized Newtonian gravity. Although the applicability of the Eq. (29) has been greatly expanded, the difficulty of solving it has increased significantly. Solving Eq. (29) can also yield a coefficient of $1/n^2$. Compared with the Schrödinger equation for solving hydrogen atoms, this is also a calculation result that allows quantization. However, whether it conforms to reality depends on whether the situation meets the quantization conditions. It is not the Sommerfeld quantization condition, but rather that "the described object must be the smallest unit charge or the smallest mass unit particle in order to have a strict and realistic quantization phenomenon".

Eq. (26)contains a wave function and is very similar to the Schrödinger equation for hydrogen atoms. It is a wave equation containing force. It tells us that the wave equation does not exclude $F=ma$, and we can use both the wave equation and classical mechanics formulas to describe particles in the same motion. Its other uses are waiting for us to jointly develop. Its other uses are waiting for us to jointly develop. It's other uses are waiting for us to jointly develop. The Schrödinger equation for hydrogen atoms can also be derived using calculus from the planetary model and $T+V+E$ (see Section 4).
According to the Wigner/Stone theorem, the unitary operator $U(\alpha)$ in Hilbert space and the principle of energy conservation are used to derive the Schrödinger equation, which extends the applicability of the Schrödinger equation for hydrogen atoms to all atoms and molecules. This method of promoting applicability is applicable to wave mechanics equations with force (because for the Schrödinger equation of hydrogen atoms, if all terms in the energy conservation equation are divided by the distance r of the force, it becomes the equilibrium equation of force). In this way, the derivation of Eq. (26) makes

quantum mechanics truly mechanics.

The expression for the impulse law in classical mechanics is $Ft$=Δ$p$, where $\Delta p = mv_2 - mv_1$. According to Eq. (12), it can be concluded that,

$$I = Ft = -\frac{i\hbar}{m}\frac{\partial}{\partial x_1}\psi_1 + \frac{i\hbar}{m}\frac{\partial}{\partial x_2}\psi_2. \qquad (30)$$

Eqs. (30) and (12) determine that Newton's third law can be expressed using wave mechanics methods.

Next, we will discuss the factors that affect quantization (i.e., the physical conditions required for quantization) and attempt to quantize Newton's gravity.

Eq. (1) is the single particle stationary Schrödinger equation and cannot describe macroscopic circuit quantum effects. If $j$ atomic nuclei are arranged in a charged parallel plate (or equivalent to a sphere), theoretically, the potential energy of an electron far away from it is $\frac{\sum_1^i Z_i e_i e}{4\pi\varepsilon_0 r}$. The idealized Schrödinger equation is $-\frac{\hbar^2}{2\sum_1^i m_i}\frac{\partial^2}{\partial x^2}\psi - \frac{e\sum_1^i Z_i e_i}{4\pi\varepsilon_0 r}\psi$=E$\psi$. The actual situation is even more complex (the shielding of inner layer electrons must be considered). Taking metals as an example, only the collective of free electrons in the energy band can be used for approximate calculations. The nuclear charge shielded by the inner layer electrons needs to be reduced. If the total number of inner electrons is i, the total potential energy of free electrons in the band is $\frac{(\sum_i^j e_k)(\sum_1^j Z_j e - \sum_1^i e_i)}{4\pi\varepsilon_0 r}$. The sum of the masses of $j-i$ free electrons in the metal band is $\sum_i^j m_k$, (k=i-j). For macroscopic systems, $r$ is a macroscopic distance that can ignore the distance between electrons in different energy levels and an infinitely charged parallel plate (or a positively charged metal sphere). In this way, the approximate Schrödinger equation for the group of free electrons in the metal band is

$$-\frac{\hbar^2}{2\sum_i^j m_k}\frac{\partial^2}{\partial x^2}\psi - \frac{(\sum_i^j e_k)(\sum_1^j Z_j e - \sum_1^i e_i)}{4\pi\varepsilon_0 r}\psi = E\psi. \qquad (31)$$

This is the case for elemental metals. The situation is slightly more complex for non elemental mixed metals, but similar equations can still be used. But this approximate equation still has the following solution

$$E_n = -\frac{\left[(\sum_i^j e_k)(\sum_1^j Z_j e - \sum_1^i e_i)\right]^2}{(4\pi\varepsilon_0)^2}\frac{\sum_i^j m_k}{2\hbar^2}\frac{1}{n^2}. \qquad (32)$$

The solution of energy quantization in Eq. (32) can reach the macroscopic level. When $2\times1836\sum_1^i m_i$ reaches the level of macroscopic mass, Eq. (32) represents the energy quantization of the collective electrons in the energy band of the macroscopic conductor. This indicates that Eq. (32) can at least approximately describe the scientific achievement of the Nobel Prize in Physics in 2025, which is the discovery of energy quantization in macroscopic circuits. This is a macroscopic quantization phenomenon under the condition of neatly arranged atomic nuclei or electrons in the " energy band" region of metals that are relatively far away from the nucleus. The conditions for macroscopic energy quantization are very demanding. Related to suitable materials, ultra-low temperature, and dissipation. Eqs. (31) and (32) have practical significance. They can describe the macroscopic quantization in the winning achievements of the Nobel Prize in Physics in 2025, and provide a demonstration for us to achieve the quantization of Newtonian gravity. As long as the coincidence of multiple particles reaches the condition of a neat jump, Eq. (31) is simpler and more practical than the quadratic quantization method.

The energy solution of the Schrödinger equation for hydrogen atoms is

$$E_n = -\frac{Z^2 e^4}{(4\pi\varepsilon_0)^2}\frac{m}{2\hbar^2}\frac{1}{n^2}. \qquad (33)$$

Although we can obtain the mathematical form of energy quantization from this solution, it cannot indicate the physical determinants of quantization. From the perspective of physical reality, the determining factor for the quantization of electromagnetic interaction energy is the existence of a minimum charge unit (most commonly an electron). Electrons jump one after another, and energy increases and decreases step by step, which is one of the forms of energy quantization. The quantization of energy from a single electron to macroscopic electromagnetic interactions requires the strict condition of many electrons jumping in sync. The energy quantization of photons is different from that of electrons. There is no need for the condition of 'minimum photon existence'(as long as it is ensured that there are no fractional photons or incomplete photons for each type of photon). If there are no fractional photons (such as half a photon, one-third a photon, etc.), as long as the photons increase one after another, The energy change caused by increasing or decreasing photons is quantized. From this energy solution Eq. (33), it can be seen that the determining factors of energy include the number of nuclear charges, the number of electron charges, the mass of electrons, and the principal quantum number $n$.

If the mass has reached a macroscopic level of disordered atomic distribution (where electrons and nuclei are irregularly distributed), the constraints of each electron's nucleus are also very complex. If the distance to the inner layer electrons is relatively close, it will also be affected by those randomly distributed electrons. In this way, it is difficult to accurately calculate the term $(\sum_i^j e_k)(\sum_1^j Z_j e - \sum_1^i e_i)$. It cannot be accurately described by a standard Schrödinger equation. In this case, whether it is a single electron or a collective of billions of electrons, can clear energy quantization be presented (that is, the energy quantization expressed by the main quantum number is disrupted. This can be seen from the molecular spectra of more complex molecules). It can be seen that whether a system composed of a large number of atoms exhibits energy quantization is related to the arrangement of the atomic nuclei, the degree of concentration of the described "relatively free electrons", and the distance from the nucleus. The basic condition for quantization that is required in both physical reality and theory is the existence of a minimum energy unit (also the particle with the smallest energy). Because the existence of such particles (which can be bosons) ensures that the particles increase one by one and the energy increases step by step (i.e. energy quantization). The same applies to the quantization of gravity, which requires the existence of a minimum mass unit particle. This is the inspiration obtained from the discussion of energy quantization conditions in this article.

In theory, the solution of Eq. (29) can reflect the quantization of electromagnetic force. However, the practical significance requires the smallest charge unit to be a unit charge. If the condition of "multiple electrons moving away from a relatively concentrated atom" is achieved through strict control, it is also possible for a situation similar to that described by Eq. (32) to occur (*i.e*., achieving macroscopic quantization).

Writing the solutions of Eqs. (28) and (29) in a form similar to Eqs. (32) and (33) can theoretically be used to describe the quantization of Newtonian gravity. Although finding the solution to Eq. (29) can achieve "mathematically allowing Newtonian gravity quantization", the microscopic and practical quantization of gravity seems to require the existence of gravitons, which are the smallest gravitational units. Or it may require the existence of a minimum mass unit. If we want to express the macroscopic quantization of gravity using the solution of Eq. (29), we must ensure that there is a collection of multiple mass units or gravitons between the two interacting objects that propagate the gravitational interaction wave by wave. It is evident that the quantization of force in classical systems encompasses at least two forms: the quantization of gravitational force in Newtonian mechanics and the quantization of electromagnetic force in electrodynamics. The quantization of gravity in the context of quantum field theory or general relativity is not within the scope of this article.

If the smallest unit of mass is not the mass of an electron, then the application of Eqs. (28) and (29) must find a particle with the smallest unit of mass (otherwise it is difficult to ensure that mass and gravity increase or decrease in a jumping manner, *i.e*. quantization).

According to quantum field theory, the current minimum mass unit is the mass of the graviton (which can be a mass equivalent to its energy). If anyone can make a large collection of these minimum mass units jump neatly, occasional macroscopic quantization of Newtonian gravity may also be possible.

As mentioned above, in principle, the quantization of gravity can be achieved by solving wave mechanics equations containing gravity (similar to the quantization of microscopic energy by the Schrödinger equation). However, to truly achieve Newtonian gravity quantization, specific conditions are still required. This condition is generally difficult to meet. This makes Newtonian gravity quantization generally only stay at the level allowed by mathematics, and appears insignificant in terms of practicality. From the perspective of physical reality, one of the important conditions for the microscopic quantization of gravity is the existence of the smallest unit that transmits gravity, such as gravitons. Many people know that the energy quantization of electrons also involves the existence of a minimum charge unit.

## 6. Results of disturbed electron diffraction experiments

**Experiment Name**: Electron Diffraction Experiment under the Interference of Magnetic Field and Light， That is, the robustness experiment of electron diffraction. For convenience, we call it the Tu electron diffraction experiment.

**Experimental objective:** To observe the changes in electron diffraction phenomena under the interference of visible light and magnetic field. So as to search for the characteristics and laws of motion electrons. There are reports that there is a phenomenon in the double slit photon diffraction experiment of photons, where as long as the monitor is turned on to monitor which slit the photon passes through, the diffraction fringes will be destroyed (the diffraction fringes will disappear). This phenomenon is explained as the observation causing quantum decoherence or wave function collapse. That is to say, this explanation is based on the belief that the anti-interference ability of quantum properties is extremely small (robustness is extremely weak). We found out who conducted this type of experiment, but we know that no one has ever used electron diffraction to conduct this type of experiment. The experiments [24] that observed the phenomenon of delayed choice quantum eraser were conducted using photons and could only indirectly verify the effect of monitoring on diffraction. To compensate for this deficiency, we designed and implemented experiments to verify the robustness of electron diffraction characteristics (or the authenticity of quantum decoherence). In other words, we are not accustomed to easily believing viewpoints that do not align with our inner voice. So, an unambiguous experiment was designed to verify the current popular viewpoint.

**Experimental instruments and tools**: electron diffractometer, permanent magnet, flashlight

**Experimental steps:** Turn on the power switch of the instrument to start working. Adjust to the optimal diffraction effect state. Scenario A: use a high-strength permanent magnet to move at the electron beam exit end and interfere with diffraction, observe the changes in the diffraction pattern.

**Experimental phenomenon description:** Scenario A. *U*se a high-strength permanent magnet to move at the electron beam exit end and interfere with diffraction, observe the changes in the diffraction pattern. Scenario B. Visible light has no visible effect on the electron diffraction pattern (See **Fig. 3**).

**Inference of experimental phenomena:** In Joseph John Thomson's cathode ray deflection experiment, the electron beam underwent a deflection that conforms to the *F=ma* law. In the experiment of this article, the diffraction pattern moving in a magnetic field indicates that the electron beam is also undergoing a deflection that conforms to the *F=ma* law (that is, the same force bias as in **Fig. 4** also occurred in the experiment of this article). The experiment in this article is equivalent to installing a slit in a cathode ray tube. The diffraction pattern does not disappear, indicating that the quantum decoherence process has not occurred, and the electrons in the electron beam are still in the microscopic world as holders of quantum properties. Electrons move longitudinally under force, but diffraction still occurs. This indicates that particles with wave particle duality can exhibit both particle and wave properties simultaneously.

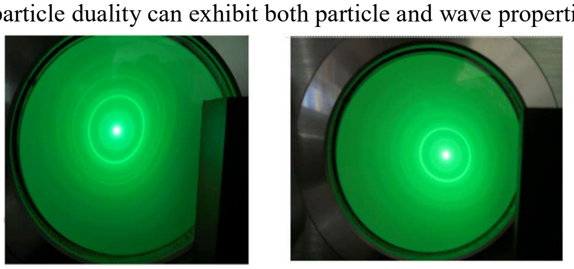

**Fig. 3.** The result of using magnetic field to interfere with electron diffraction. The electron beam moves laterally along the direction of force, causing diffraction fringes to deform and move

as a whole, but not disappear. During the diffraction process, electron rays can exhibit both particle characteristics and wave law simultaneously.

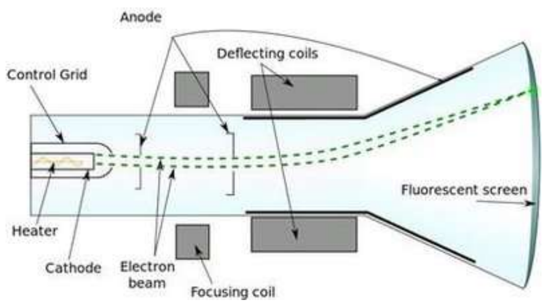


**Fig. 4.** Schematic diagram of Thomson cathode ray deflection experiment principle. Image source: https://p0.ssl.qhimgs1.com/sdr/400__/t0136f39cb9fcded8d0.jpg

The Tu's electron diffraction experiment unequivocally proves that electron diffraction has strong anti-interference ability (robustness). Electron diffraction is also a quantum property of electrons. Since the supervised interference did not disrupt the quantum properties, it indicates that the supervised interference did not cause quantum decoherence (or superposition collapse). In this way, the results obtained from measuring microscopic particles may not necessarily be collapsed, at least a considerable portion of them are "original existence". The results of the double slit diffraction experiment of photons with monitoring devices should seek other explanations. One explanation is that when the light passes through a slit without being monitored, it generates secondary wavelets according to Huygens' principle, and interference is caused by the secondary wavelets. When monitored by means such as photons, Huygens' principle is disrupted and diffraction patterns cannot be seen. In this way, the results of the Tu's electron diffraction experiment can indicate that during the electron penetration process, both state superposition and superposition collapse may not occur or do not exist. The quantum superposition and quantum superposition collapse process, quantum decoherence process, Bohr complementary relationship between wave and particle properties of moving particles, etc. do not seem to exist. This conclusion and explanation do not deny the main framework of the mathematical form of quantum mechanics. We can observe both particle characteristics that conform to $F=ma$ and wave characteristics that conform to diffraction laws (which are exhibited by moving particles in simple and stable diffraction experiments without ambiguity).

The Tu's electron diffraction experiment shows that the particle size and wave behavior of moving particles can be exhibited simultaneously. And it exhibits the classical characteristics of particles (such as orbital displacement of particles, adherence to the law of $F=ma$, etc.). Since it has been proven through experimental methods that the classical and wave characteristics of moving particles can be simultaneously manifested, it is proving through experimental methods that 'wave mechanics and classical mechanics are compatible'. Before this section, we used both theoretical and practical methods to demonstrate this point.

The phenomena illustrated in Figures 1 and 2 can occur in the same experiment using the same instrument. That is, the classical particle characteristic of electron beams being bendable in a magnetic field and the wave characteristic of diffraction occurring when electrons pass through a slit can be displayed simultaneously. On the same particle, both classical and quantum properties are exhibited, indicating that classical mechanics and quantum mechanics are compatible, and the laws of classical mechanics and quantum mechanics can work simultaneously on the same object.

The result of the Tu's electron diffraction experiment is that the anti-interference ability of the electron diffraction characteristics is very strong. The significance of this result is either that the measurement or observation cannot cause the microscopic characteristics of electrons to decoherence to classical characteristics, or that various collapse processes in quantum mechanics interpretation are not real, reflecting that "electron diffraction characteristics exist originally" rather than wave function collapse. The experimental results also indicate that the "non real" behavior of microscopic particles during diffraction is questionable. In other words, the experimental results demonstrate that various collapses did not occur due to observation, and the observed existence or appearance is the "original existence" (*i.e.*, physical reality) of the observed particles. The viewpoint that the macroscopic objects described by classical mechanics have reality and that quantum mechanics is compatible with classical mechanics is extremely advantageous.

Based on the theoretical conclusion of this article that quantum mechanics and classical mechanics are compatible, the experimental results of single slit electron diffraction under magnetic field and photon interference, and the collapse of wave functions and quantum decoherence processes are not physical realities, we can make the following predictions. **Prophecy 1:** the superposition experiment of two single slit diffraction in a magnetic field must have the following result: the deflection of the electron beam carrying electron diffraction information conforms to the classical electrodynamics law and Newton's second law. At the same time, the electron diffraction pattern moves and deforms, but does not disappear due to interference. This is the prophecy that "non reality" and "superposition of states phenomena" do not exist, and that the particle and wave characteristics of moving particles can be manifested simultaneously.”The four characteristics of the experiment on the superposition effect of double slit diffraction in a magnetic field are: (1) The electron diffraction experiment is conducted in a magnetic field (*i.e.*, the Thomson cathode ray deflection experiment and the electron diffraction experiment are conducted in the same device in a magnetic field); (2) The slit is a double slit arranged side by side; (3) There are two electron emission methods: sequentially passing electrons through a slit one by one and simultaneously passing multiple electrons through a slit; (4) First, cover one slit to conduct a single slit experiment, then cover another slit to conduct a single slit diffraction experiment, and let the electron beam accumulate on the same screen. Diffraction fringes are a combination of "accumulation" and "interference" effects. The four characteristics of the experiment mentioned above are also the experimental plan and the experimental results of prophecy. **Prediction 2**: The diffraction pattern can still be obtained from the second diffraction of the double electron diffraction experiment. Double electron diffraction experiment refers to digging a small hole or slit in the center of the receiving screen of the first diffraction as the slit or small hole of the second diffraction. **Prophecy 3**: Let the electron beam deflected in the magnetic field pass through the slit and still produce diffraction. This is an experiment that combines the Thomson cathode ray deflection experiment with electron diffraction. It can still be used to obtain diffraction patterns. Now, convert the cathode ray tube into a small cyclotron and let the emitted electron beam pass through a slit and potential barrier. We predict (Prophecy 4) that this electron beam, believed to be quantum decoherent, can still obtain an electron diffraction pat**tern** through a slit, and tunneling can still be achieved when it encountering a potential barrier.

If the experiment can verify the four predictions above, then these verifications, together with the results of the Tu electron diffraction experiment, prove that we cannot deny the "original existence" of microscopic particles, and the conclusion that "all experiments prove that the interpretation of quantum mechanics is correct" is incorrect. It can be seen that experiments to verify these prophecies are very important.

## 7. Conclusion and Discussion

The composition, structure, and function of the Schrödinger equation determine the combination of quantum mechanics and classical mechanics. This combination leads to the wave mechanics equation with force, a series of mechanical quantities, and the wave mechanics representation method of classical mechanics laws. And this in turn determines the formation of a new theoretical system - this new theoretical system is general wave mechanics. How does general wave mechanics describe hydrogen atoms? If a planetary model is used, how does it solve the stability problem of hydrogen atoms? As we all know, as long as the stability problem is solved, planetary models can still be used in the microscopic world. The planetary model is applicable to the 1s electrons of hydrogen atoms and over a hundred elements, which cannot be explained solely by coincidence. The method we adopt is that firstly, we acknowledge the fact that electrons in hydrogen atoms do not emit electron magnetic waves outward. In scientific research, any fact can be directly utilized (for example, the way electron spin occurs is unclear, and the source of electron spin magnetic moment is unclear. However, electron spin is a fact, and we are all utilizing this fact). Secondly, consider how to explain this fact. If we use "unknown strange ways" or "unknown motion modes" to explain, it is equivalent to having no explanation (*i.e*., "using agnosticism to explain stability without using planetary models" does not have an advantage). It can be seen that as long as we acknowledge and utilize this fact. It would be even better if this fact could be explained. We consider the problem from the perspective of a new theory of electronic structure and propose an explanation for the source of electron spin magnetic moment, while avoiding the stability difficulties of hydrogen atoms in planetary models. For "quantization" and "tunneling effect"， our way of thinking is that both quantization and tunneling effects are the characteristics Increased due to the small size of microscopic particles. For example, when an electron becomes so small that it is the smallest charged elementary particle, the energy increases step by step as the electron increases one after another (as long as the electron is the smallest in this process, the process is quantized); No matter what material it is, there are usually large gaps between the atoms inside. Electrons much smaller than gaps can easily pass through, while larger macroscopic objects cannot pass through. The tunneling effect is a characteristic that is highlighted on the basis of macroscopic laws as the target particle becomes smaller. It still follows the rule of 'large objects cannot pass through small gaps, small objects can pass through relatively large gaps'.

Classical mechanics and quantum mechanics are compatible, so that general wave mechanics can be established. Most people have at least two questions: first, how to overcome the contradiction between quantum probability and classical stability and certainty; Secondly, how can quantization be coordinated or unified between "classical" and "quantum"? This is worth discussing and unavoidable. For the discussion of the first question, let's first delve into the composition, structure, and function of Eq. (1) of the steady-state Schrödinger equation, as well as its relationship with classical mechanical laws. By calculating the partial differential of each term in Eq. (1), we can obtain $\frac{p^2}{2m}\frac{\partial^2}{\partial x^2}\psi+V\psi=E\psi$. Substituting $\frac{p^2}{2m}=T$ into it, we can obtain

$$T\psi+V\psi=E\psi. \qquad (34)$$

The $\psi$ in Eq. (34) can be eliminated, resulting in $T+V=E$. By replacing T in equation (34) with an operator form, it becomes Eq. (1). As we all know, the Viry theorem can find applicable spaces in both microscopic and macroscopic systems. And $T+V=E$ is one of the expressions of the Viry theorem. According to the principle of least action, in macroscopic systems, the steady-state system to which the Viry theorem applies must be a planetary model system (*i.e*., a constrained system in which the dependent object undergoes uniform circular motion). We do not have sufficient reason to believe that 'in the microscopic world, the principle of minimum action also fails, and the condition that determines the validity of the Viry theorem is not the planetary model system'. In this case, it is difficult to logically deny the use of the planetary model by using the steady-state Schrödinger equation.

Supplementary material A introduces the process of deriving the Schrödinger equation based on classical mechanical laws. This, together with the above argument, indicates that the Schrödinger equation can be transformed into expressions for $F=ma$ and the Viry theorem. This is one of the theoretical proofs that "quantum" and "classical" can be compatible and combined.

The Tu's electron diffraction experiment proved that the diffraction characteristics of electrons have strong robustness. This raises doubts about concepts such as quantum state superposition, uncertainty, quantum decoherence (or wave function collapse or wave packet flattening). The fact is that there is a lack of experiments that can directly verify these concepts. On the contrary, there are experiments that deny these concepts, such as the Tu electron diffraction experiment. Being able to express classical mechanics laws using wave mechanics methods and potentially establish a theoretical system of general wave mechanics based on this. Therefore, the Tu electron diffraction experiment, which is extremely advantageous for the viewpoint that "quantum mechanics and classical mechanics can be combined", is an important link in the "theoretical, practical, and experimental evidence chain". If readers with conditions verify our predictions 1-4, the conclusions of this article will be even more reliable.

The compatibility between quantum mechanics and classical mechanics will gives birth to general wave mechanics, and there are still some side issues that need to be addressed. For example, the application of the concept of particles; The application of the concepts of speed and acceleration; Spatiotemporal symmetry (the invariance of physical laws under Lorentz transformations). Quantum mechanics does not completely exclude the concepts of center of mass and masspoint. For example, an electron cloud is a collection of spatial points where the center of mass (particle) of electrons outside the nucleus has appeared or is about to appear. That is to say, the concepts of electron cloud and probability density simultaneously use the concepts of center of mass and particle. Quantum mechanics also uses the concept of velocity (such as the phase velocity and group velocity of de Broglie waves. The momentum of particles also includes velocity). Since the concepts of velocity and particle are used simultaneously, from a realistic perspective, the motion of a particle cannot be different from s=υt (as long as the electrons outside the nucleus do not travel from one point to another in a stealthy manner, there is a real displacement of the electrons). The second derivative of the function $s=\upsilon t$ with respect to t is the acceleration. You can assume that this acceleration does not require the action of force, but you cannot erase the value of this non-zero acceleration out of thin air.

In general, to incorporate Newtonian mechanics into the quantum mechanics system, Newtonian mechanics needs to change the quantization of physical reality, while quantum mechanics needs to change the denial of the original existence of microscopic particle properties. One of the strong proofs that quantum mechanics and classical mechanics can be compatible so that they can be combined for use is that this combination can be achieved in applications [23-26]. The combination of quantum mechanics and special relativity is very successful (for example, Dirac theory). This also indicates that the difficulty of combining quantum mechanics with Newtonian theory is not insurmountable.

Next, we will discuss the impact of this article's explanation of the Aspect experiment and the premises or basic concepts of quantum mechanics explanation

We also need to define the original existence: 'Original Being' is actually 'Primordial Existence' (Original Being), which belongs to the philosophical category and refers to the starting point or fundamental state of existence itself. It is an objective existence that existed before our observation. Or it is an objective, real, and relatively stable thing that has already appeared before being subjected to destructive effects, unrelated to environmental or external influences, and not subject to human consciousness transfer. Things at a stage starting point can be called relative primordial existence or stage primordial existence. The following are the reasons why the double slit diffraction experiment and Aspect experiment cannot firmly reject the domain realism.

The core idea (core concept, premise, or fundamental concept) of the existing quantum mechanics interpretation system denies the original existence of microscopic particles (DOEMP). DOEMP is the fundamental premise (basic concept) of the quantum mechanics explanatory system. The establishment of the mathematical system of quantum mechanics does not require this fundamental premise (core concept). The mathematical system of quantum mechanics is based on the Schrödinger equation and the Dirac equation. Most people now believe that the mathematical system of quantum mechanics is based on Hilbert spaces and group theory. Regardless of what is said now, at the beginning of the establishment of quantum mechanics, people believed that the mathematical formal system of quantum mechanics was established by Schrödinger, Heisenberg, and Dirac without directly using the mathematical theory (group theory and Hilbert space). The basic framework of quantum mechanics theory is established based on logic. Therefore, the logical framework of quantum mechanics does not require DOEMP. The textbook of quantum mechanics is also based on the logical framework of quantum mechanics, so DOEMP is not mentioned much. DOEMP is only used when explaining systems using quantum mechanics. But it is not explicitly stated that it is a fundamental premise of quantum mechanics. In the teaching process of imparting knowledge, the situation is even more so that after multiple generations of inheritance, few students and theoretical workers in the field of quantum mechanics now know about that quantum mechanics has the basic premise of DOEMP (even if they know about DOEMP, they do not regard it as a basic premise but instead propose the principle of superposition of states). In short, scholars in the field of quantum mechanics rarely explicitly think of or mention DOEMP (just put it in the subconscious). When debating with Bohr, Einstein sometimes forgot DOEMP and needed Bohr to remind him. Now, supporters of non local realism quantum mechanics also intentionally avoid mentioning DOEMP. The reason is that DOEMP cannot be directly verified through experiments, and repeating it is actually detrimental to quantum mechanics. The interpretation of aspect experimental results must also use DOEMP. DOEMP has not been experimentally validated, which is a significant logical vulnerability in Aspect experiments.

Strangely, this unverified DOEMP is almost always used implicitly without mentioning it as a fundamental premise (fundamental concept of premise) when providing explanations for quantum mechanics. Advocates of non local realism quantum mechanics may argue that although " DOEMP" has not been directly confirmed by experiments, practical applications and extensive experiments have indirectly proven the correctness of quantum mechanics, thus indirectly proving DOEMP. However, the reality is that all quantum mechanics experiments are explained using DOEMP. Just like in the Aspect experiment. The statement 'engineering applications or production practices have proven the correctness of quantum mechanics' is not rigorous. The reason is that even without the birth of quantum mechanics theory, electronic devices and communication technologies in current production practices will still develop. In engineering applications, it reflects the real situation after the collapse of quantum superposition states, and the opposite processes of state superposition and superposition state collapse cannot be reflected. This pair of opposite processes only exists in subjective consciousness (*i.e.*, it can be considered that these two opposite processes do not exist). It is entirely possible that the subsequent processes of two completely opposite processes were set up to eliminate the falsehood of the previous process. This is especially true when neither of these processes can be directly verified (as long as the state superposition process is false, a superposition state collapse is necessary to achieve consistency between the measured results and reality). Moreover, the design in engineering applications is guided by the mathematical system of quantum mechanics, rather than the interpretation system of quantum mechanics. The so-called quantum communication is also communication using photons, rather than communication using quantum entanglement characteristics. It can be seen that the statement DOEMP has been indirectly proven' is not rigorous.

Some people may argue that the result of the argument with Bohr is that Einstein lost. As long as we analyze carefully, it is not difficult to find that Einstein did not lose, but fell into a trap - he accepted DOEMP due to the influence of the overall environment. He argued with Bohr under the common premise of DOEMP. The focus of the debate is whether the linkage caused by the ghostly long-range effect is determined by logical connections. Einstein said it's better to have it (otherwise quantum mechanics is incomplete), Bohr said it's not. However, logically speaking, if one believes in DOEMP, there is no need for logical connection in that type of long-range linkage. So, on the premise of believing in DOEMP, Einstein's concerns are unnecessary. The aspect experiment has nothing to do with their argument (cannot judge their argument). It is not difficult to see that Einstein wanted to make quantum mechanics more complete by using the correct approach to prove the validity of the erroneous DOEMP, but he failed and was despised. Bohr was completely superstitious about DOEMP and received applause.

The content of the sophistry and deception series based on DOEMP includes: before measurement, the composition, structure, spin, and motion of microscopic particles are mostly uncertain, and some are in a superposition state. Not acknowledging that the measured localized reality and deterministic results reflect the original existence of microscopic boundaries, but believing that the measured objective reality is a collapse caused by measurement. Even if the physical quantity state is accurately measured, it is not recognized. The magnetic moment caused by spin is measured, but classical rotation is not recognized. These bizarre operations have never appeared in the history of new technology, only in quantum mechanics. The setting of superposition collapse has blocked the experimental verification path of these operations, therefore, the DOEMP premise itself and the series of operations that maintain it cannot and have not been directly verified. To make it difficult for these operations to escape suspicion of sophistry and deception.

Next, we will discuss the phenomenon of double slit diffraction experiment.

There is more than just the Copenhagen interpretation to explain the double slit diffraction experiment. There are four main explanations that acknowledge or support the reality of particles undergoing diffraction (see table).

**Table 1.** Realistic Explanation of Double slit Diffraction Experiment

| No | Explanation method | Objective substantiality | Core mechanism | Answer to 'Which seam does the particle pass through' |
|---|---|---|---|---|
| **1** | De Broglie Bohm | Both particles and guided waves are reality | Quantum potential guidance | There is a definite path, but it is affected by guided waves |
| **2** | Many worlds | All branches are reality | Cosmic wave function splitting | In all branches, each branch only passes through one seam |
| **3** | Decoherence | Decoherent states are classical states | Environmental entanglement leads to information leakage | Dependent on specific measurements and environmental factors |
| **4** | Ensemble | The statistical results are accurate | Collective statistical behavior | A single particle only passes through one, but the ensemble distribution shows interference |

Next, we will discuss the advantages of coordinating classical and quantum approaches to establish generalized wave mechanics

For a considerable period of time before the current stage, quantum mechanics and classical mechanics were seen as incompatible and opposing. After establishing the compatibility between quantum and classical, it was proven that they can be used simultaneously to describe macroscopic and microscopic phenomena. Generalized wave mechanics that can reconcile classical and quantum mechanics". Eliminating the binary opposition between classical and quantum, and conforming to the law of logical rotation of cognition. The development process of classical mechanics → quantum mechanics → generalized wave mechanics that can reconcile classical and quantum mechanics is a profound understanding. The wave equation can be used to represent classical mechanical laws and more classical physical quantities. Therefore, this development process can incorporate the positive achievements of classical mechanics and quantum mechanics. It can reduce (eliminate) many contradictions in existing quantum mechanics, making human understanding of the macroscopic and microscopic worlds more thorough and profound. A macroscopic quantization scheme for Newtonian gravity has been proposed, which provides some inspiration for achieving Einstein's gravity quantization. These are the advantages of generalized wave mechanics introduced in this article.

## 8. The significance of "quantum and classical compatibility, general wave mechanics combining quantum mechanics and classical mechanics"

The outdated notion that "quantum mechanics is incompatible with classical mechanics" has been revised to "quantum mechanics is compatible with classical mechanics and can be used in combination. They can also be integrated into ' general wave mechanics' (indicating the mathematical foundation of general wave mechanics)". The significance of this work is similar to Copernicus' proposal of the heliocentric theory, which changed people's perspective on the world. Changed the perspective from which humans view the world (and also changed their established beliefs), returning their understanding of the world to the correct track of "realism, determinism, and certainty", which is consistent with the experience and common sense accumulated by humans over the long years. And it is only the most dialectical fusion of quantum and classical, rather than a complete denial of each other. Give humans a sense of spiritual comfort. After establishing general wave mechanics, quantum mechanics must adopt new expressions. Whether or not people still believe that there is a contradiction between quantum mechanics and classical mechanics, the establishment of the framework of general wave mechanics has the function of "changing some old concepts of quantum mechanics" and "simplifying quantum mechanics calculations". The establishment of general wave mechanics may lead to a research boom in the "wave element material structure theory".

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**Supplementary Material A:** Derive the Schrödinger equation from the principle of minimum action

The mathematical expression for the principle of small quantity and action can be written as

$$\mathrm{S} = \int_{t_1}^{t_2} L dt \psi. \qquad \text{(A1)}$$

Take L as

$$L = T + V = \frac{1}{2}\mathrm{m}\dot{q}^2 + V(q). \qquad \text{(A2)}$$

$$m\ddot{q} = \frac{\partial V}{\partial q} = F. \qquad \text{(A3)}$$

Here, q is the distance r. Eq. (A3) is the expression for Newton's second law. Write Eq. (3) in the most familiar form, which is $F=ma$.

Since L is the energy E here, take the first equation of Eq. (A2).

$$E = T + V. \qquad \text{(A4)}$$

Multiplying both sides of F=ma by the interaction distance r, and considering a $= \frac{dv}{dt} = \frac{v^2}{r}$, $Fr=mar$ can be transformed into $V=mv^2$ or

$$V = 2T. \qquad \text{(A5)}$$

Eqs. (4) and (5) are both expressions of the Viry theorem. Comparing them, it can be concluded that, $E=-T$.

Multiplying both sides of equation (A4) by $\psi$,we can obtain $E\psi = T\psi + V\psi$. Considering that $\psi = \psi_0 e^{-\frac{i}{\hbar}(Et-px)}$, $f(i, \hbar)\frac{\partial^2}{\partial x^2}\psi = T = \frac{p^2}{2m}$, and we can obtain $f(i, \hbar) = -\frac{\hbar^2}{2m}$ or $\hat{T} = \frac{\hat{p}^2}{2m} = -\hbar^2\frac{\partial^2}{\partial x^2}$. Substituting $\hat{T} = -\hbar^2\frac{\partial^2}{\partial x^2}$ into $E\psi = T\psi + V\psi$, we can obtaain

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi + V\psi = E\psi. \qquad \text{(A6)}$$

Eq. (A6) is the steady-state Schrödinger equation. For the planetary model system, considering Eq (A4) in the main text, $E$ in Eq. (A6) is the energy eigenvalue of the system $E = -T = -\frac{1}{2}mv^2 = -\frac{1}{2}h\nu$.