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The Schrödinger Equation Used the Wrong Energy Relationship

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ABSTRACT

According to the energy relationship of the ground state solution of a hydrogen atom using the Schrödinger equation, the kinetic energy of an electron at twice the Bohr radius becomes zero. The electron has zero kinetic energy, which means it is dead, indicating that the energy relationship used in the Schrödinger equation is incorrect. Then, the reasons for both the chaotic energy relationship of the Schrödinger equation and the half frequency problem encountered by Bohr are analyzed. Bohr only considered Coulomb force and established an equation with centrifugal force, but he did not consider Lorentz force. So, the frequency he obtained must be multiplied by 1/2 to match the experimental value. This article also analyzes other issues related to the Schrödinger equation.

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The emergence of relativity and quantum mechanics in the early 20th century raised two flags in the history of scientific development. Over the past century, most scientific discoveries and new research results have been gathered under these two flags. Quantum mechanics mainly uses two mathematical methods: partial differential equations and giant arrays. Regarding the giant array, Karabalievich, A. N., a chemical science candidate from the Republic of Kazakhstan, recently published an article revealing the hidden flaws in the mechanics of the giant array [1]. The article quotes a passage from Einstein: "The most interesting theoretical achievement of recent times is the Heisenberg-Born- Jordan theory of quantum states. A real witchcraft calculus in which infinite determinants (matrices) appear instead of Cartesian coordinates. It is highly witty and, due to its complexity, is insured against proving erroneous". Regarding partial differential equation, its main body is the wave equation established by Schrödinger in 1926 [2]. In 2023, Indian independent researcher Gurcharn S Sandhu "proved a logical flaw in the development and interpretation of the Schrödinger equation [3]. In the development of the hydrogen atom Schrödinger equation, the assumption of a time invariant potential energy term was the first mistake to permanently restrict the movement of electron along circular orbit. He pointed out in 2018 that the Schrödinger equation contains incorrect potential energy terms [4]. However, through research, this article believes that there are many errors in the Schrödinger equation, and the main error is the use of chaotic energy relationships, among which only the potential energy term is still correct.

Chaotic Energy Relationships

Let's first take a look at the absurd results generated by both the energy relationship used in establishing the Schrödinger equation and the solutions obtained, and then analyze where the Schrödinger equation went wrong.

The Schrödinger equation was established using the simplest example of hydrogen atom, where the total energy E of an electron is equal to the sum of its kinetic energy T and potential energy V

$$E=T+V \qquad (1)$$

In his original paper in 1926 [2], he established the (1″) formula as

$$(1'')\quad \underbrace{\left(\frac{\partial\psi}{\partial x}\right)^2+\left(\frac{\partial\psi}{\partial y}\right)^2+\left(\frac{\partial\psi}{\partial z}\right)^2}_{T}-\underbrace{\frac{2m}{K^2}\left(E+\frac{e^2}{r}\right)}_{E\ \ V}\psi^2=0;\quad r=\sqrt{x^2+y^2+z^2}$$

Equation (1″) can be rewritten in the form of Equation (1)

$$E\psi^2=\frac{K^2}{2m}\left\{\left(\frac{\partial\psi}{\partial x}\right)^2+\left(\frac{\partial\psi}{\partial y}\right)^2+\left(\frac{\partial\psi}{\partial z}\right)^2\right\}-\frac{e^2}{r}\psi^2 \qquad (2)$$

$$r=\sqrt{x^2+y^2+z^2}$$

Solving the Schrödinger equation of a hydrogen atom yields a ground state 1s solution, with its normalized time-dependent wave function, $\psi_{nlm}=\psi_{100}(r,t)$, where,

$$\psi_{100}(r,t) = \sqrt{(\frac{1}{\pi a_0^3})} \cdot e^{-r/a_0} \cdot e^{-iE_1 t/\hbar} \qquad (3)$$

where, a_0= 5.3×10^{-11} m is the Bohr radius, E = -2.18×10^{-18} J = −13.6 eV is the total energy of the 1s orbital, $\hbar = h/2\pi$ =1.05 ×10^{-34} J•s is the reduced Planck constant and $0 < r < \infty$ is the radial displacement of electron. According to later probability explanations, in the spatial range of $0 < r < \infty$, there is a probability that 1s electron will appear, that is, [4]

$$|\psi_{100}|^2 = (\frac{1}{\pi a_0^3})e^{-2r/a_0} \qquad (4)$$

For the ground state solution of hydrogen atom, the total energy is a constant, E = -13.6 eV; The potential energy V is inversely proportional to r, that is, V= - ke^2/r=[-8.99×10^9 × (1.60×10-19)^2 /r] J = (-2.30×10^{-28} /r) J = (-14.4 /r) eV; The kinetic energy $T = E - V$. The variation of each energy relative to r is plotted in Figure 1.

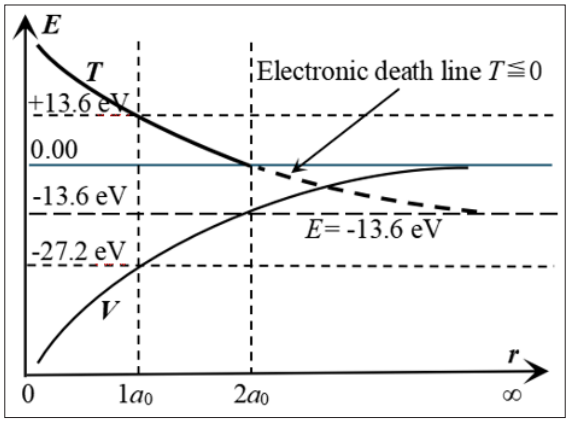

Figure 1: According to the Energy Relationship of the Schrodinger Equation, when $r \geqq 2a_0$, the kinetic energy $T \leqq 0$, the electron dies.

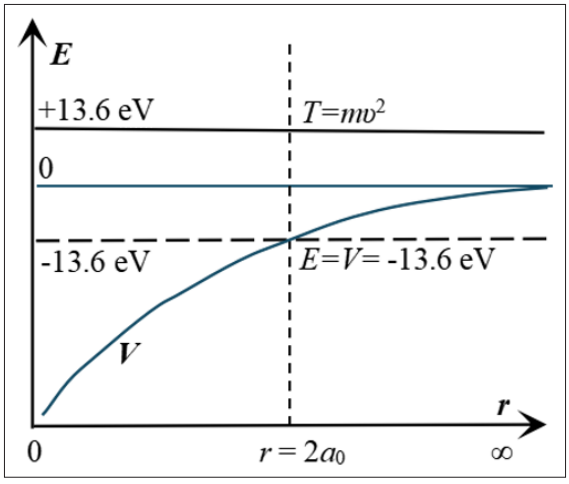

Figure 2: According to the New Model, Electrons in the ground state Hydrogen Atom can only move on Circular Orbits with Radius $2a_0$.

In Figure 1, the ground state energy E = -13.6 eV is represented by a dashed thick line, which does not vary with r; The absolute value of potential energy V is inversely proportional to r, forming a curve in the negative energy region. The absolute value of V gradually decreases as r increases and approaches the zero line. At $r = 1a_0$, V = -27.2 eV, $T = E - V$ =-13.6 - (-27.2) = 13.6eV. At $r = 2a_0$, V = -13.6 eV, $T = E - V$ = -13.6 - (-13.6) = 0 eV. According to the probability of the wave function, a 1s electron can reach $2a_0$ and anywhere from zero to infinity. But when the electron reaches $2a_0$, its kinetic energy drops to zero, indicating that the electron is no longer moving, that is, dead. This is the absurd result caused by the chaotic energy relationship used in the Schrödinger equation [5].

Before the establishment of quantum mechanics, according to classical mechanics, all charged particles moving along a closed orbit have a centripetal acceleration. Charged particles that accelerate will radiate electromagnetic waves, thereby transferring their energy to the electromagnetic field. Therefore, the energy of electrons moving around the nucleus will continuously decrease until they fall onto the nucleus [6]. Due to the contradiction between classical mechanics and atomic stability, quantum mechanics replaced classical mechanics. It is very humorous that this article finds that the electron death caused by the Schrödinger equation is also contradictory to the stable existence of atoms.

In order to avoid the absurd results of the Schrödinger equation, I established an algebraic model of the hydrogen atom structure (hereinafter referred to as the algebraic model) [7]. Algebraic models happened to develop Bohr and Sommerfeld's classical models, as shown in Figure 2, avoiding the death of electrons. The electrons in the ground state hydrogen atom move in a circular orbit with twice the Bohr radius ($r = 2a_0$). Its kinetic energy is constant (+13.6 eV), and its ground state energy level energy is equal to its potential energy: $E_n = V$ = -13.6 eV. The total energy is zero, meaning the sum of kinetic energy and potential energy is zero In steady state, the energy and orbital radius of electrons are both determined and quantized. I have proven that planets or satellites, like electrons in atoms, have centrifugal kinetic energy equal to potential energy when in circular orbit, and their sum is zero [8].

The Fountainhead of Chaotic Energy Relationships

I found that the muddled energy relationship began in the history of science when Coriolis proposed his kinetic energy formula in 1829.

Kepler and Newtonian Mechanics Formulas are Correct

German astronomer Johannes Kepler (1571-1630) proposed his third law in his book "Harmony of the World" in 1619, which states that for the orbital motion of a planet, the cube of its semi major axis is proportional to the square of its period [9]. Based on this, Newton discovered the law of universal gravitation

$$F = \frac{GMm}{R^2} \qquad (5)$$

where F, G, M, m, and R are universal gravitation, gravitational constant, approximate solar mass, planetary mass, and the distance from the planet to the center of mass of the sun respectively. Kepler's third law can also be derived by using the equality of universal gravity and centrifugal force

$$\frac{GMm}{R^2} = \frac{m\upsilon^2}{R} \qquad (6)$$

Where υ is the orbital velocity of the planet. Multiplying both sides of equation (6) by R yields

$$\underset{\text{potential energy}}{\frac{GMm}{R}} = \underset{\text{kinetic energy}}{m\upsilon^2} \qquad (7)$$

By verification, equation (7) is applicable to the orbital motion of all planets and satellites in the solar system [8].

Leibniz Kinetic Energy and Coriolis Kinetic Energy

The equation (7) is the energy solution of the Kepler problem, where the potential energy on the left is gravitational potential energy and the kinetic energy on the right is Leibniz Kinetic Energy $m\upsilon^2$, we also refer to it as Centrifugal Kinetic Energy but not Coriolis Kinetic Energy $(1/2)m\upsilon^2$.

Gottfried Wilhelm Leibniz (1646-1716) was a renowned German philosopher and mathematician. He officially referred to $m\upsilon^2$ as "vis viva" in his article "Specimen dynamics" published in the 1695 Journal of Teachers, and used $m\upsilon^2$ as the unit of measurement for motion. The concept of kinetic energy was first introduced into physics [10]. More than a century later, French engineer and physicist Coriolis, Gustave Gaspard de (1792-1843) proposed a formula $(1/2)m\upsilon^2$ for calculating kinetic energy from the perspective of applied physics and engineering mechanics in 1829.

Difference between Two Types of Kinetic Energy

Kinetic energy is defined as the energy possessed by an object due to its motion. Leibniz kinetic energy and Coriolis kinetic energy both conform to the definition of kinetic energy. Coriolis kinetic energy is widely used in applied physics and engineering mechanics due to its ease of calculation. Although the equation (7) in astrophysics and the mass-energy relationship equation $E=mc^2$ in high-energy physics both conform to the Leibniz kinetic energy formula, the lack of distinction between the two types of kinetic energy in theoretical physics has led to the dominance of Coriolis kinetic energy in physics to this day.

Kinetic energy is a state function and an instantaneous physical quantity. Work is not a state function, it is a process quantity. For the work process of variable speed, the Coriolis kinetic energy can be derived or calculated by the work-kinetic energy theorem. An object in uniform motion does not do work, therefore the kinetic energy formula derived from the work-kinetic energy theorem is not suitable for calculating the kinetic energy of uniform motion. As early as the late 19th century, German philosopher F. Engels (1820-1895) pointed out that "in the absence of both mechanical motion and other forms of energy conversion, the transmission and variation of motion can be measured by momentum; but when mechanical motion and other forms of motion energy conversion occur, kinetic energy is used to measure it [11]. According to Engels' understanding, kinetic energy should not be used to handle uniform motion without doing work. It can be seen that before the 20th century, there were still differences in the application of momentum and kinetic energy.

According to the law of conservation of energy in current physics textbooks, the mechanical energy of planetary orbital motion is equal to kinetic energy plus potential energy. What is the mechanical energy in this equation? According to the author's statement in the article "Motion", when using Leibniz kinetic energy or centrifugal kinetic energy for the orbital motion of planets or satellites, $T = V$, or $T + (- V) = 0$. As the law of conservation of energy by it, this is both simple and true. I have analyzed the difference between Leibniz kinetic energy ($m\upsilon^2$) and Coriolis kinetic energy ($½m\upsilon^2$) in reference [8]. Simply put, if an object's velocity decreases from υ to 0 due to doing work W, the work should be equal to the change in kinetic energy ΔT. The following equation is obtained by the work-kinetic energy theorem

$$W = \Delta T = T_2 - T_1 = m(\frac{\upsilon}{\sqrt{2}})^2 - 0 = \frac{1}{2}m\upsilon^2 \qquad (8)$$

Because T_1=0, therefore

$$W = T_2 = \frac{1}{2}m\upsilon^2 \qquad (9)$$

But which velocity should the kinetic energy represented by T_2 belong to? It is generally believed that T_1 is the kinetic energy at rest, and naturally T_2 is the kinetic energy at velocity υ. Actually, that's where the problem lies. We can use a simple uniform deceleration process as an example for analysis.

In the process, according to the definition of work, work (W) = force (F) × distance (L); Force (F) = mass (m) × acceleration (a); Acceleration = (difference in velocity)/time; Distance = average speed × time. Note that this is the average speed, not the speed υ

$$W = F \cdot L = ma \cdot L = m \cdot \frac{\upsilon - 0}{t} \cdot \frac{\upsilon + 0}{2} \cdot t = m \cdot \frac{\upsilon}{t} \cdot \frac{\upsilon}{2} \cdot t = \frac{1}{2}m\upsilon^2 \qquad (10)$$

Equation (10) indicates that $\upsilon^2/2$ is obtained by multiplying two factors, υ and $\upsilon/2$. υ contributes to acceleration and ultimately contribute to the force F, $\upsilon/2$ contributes to distance L. The work done by the process or the change in kinetic energy, $m\upsilon^2/2$, is determined by three velocities (υ, 0, and $\upsilon/2$). Because the relationship between kinetic energy and velocity is not linear, it is not appropriate to assign kinetic energy ($m\upsilon^2/2$) to any of these three velocities. The most suitable one should be assigned to $(\upsilon/\sqrt{2})$, where $(\upsilon/\sqrt{2})$ is the root mean square of $\upsilon^2/2$. That is to say, the work done by the process is neither equal to the kinetic energy of the object at rest, nor equal to the kinetic energy of the object at velocity υ, nor equal to the kinetic energy of the object at average velocity ($\upsilon/2$), but equal to the kinetic energy of the object at root mean square velocity ($\upsilon/\sqrt{2}$). In this way, the work-kinetic energy theorem can be compatible with Leibniz's kinetic energy, consistent with equation (7) in astronomy, and also consistent with Einstein's mass energy relationship. It can also be simplified as Coriolis kinetic energy in applied physics or engineering mechanics. Figure 3 shows that Schrödinger mistakenly used the Hamiltonian energy relationship.

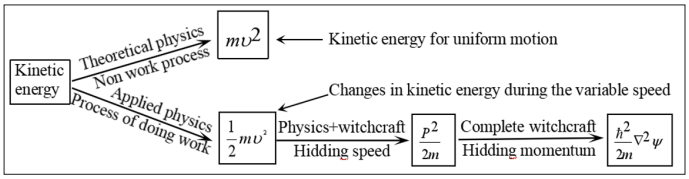

Figure 3: Wrong Kinetic Energy in Schrodinger Equation. In hydrogen atoms, the electron velocity is equal to the product of the speed of light and the fine structure constant, which is a constant. Of course, the Kinetic Energy of electrons is also constant. After three steps of Operation, the constant Kinetic Energy becomes a Magic Wave Function.

In engineering, an object moving at a constant speed (υ) does not do any work, and its kinetic energy is ($m\upsilon^2$). When it decelerates to a standstill by doing work, it can only do work ($m\upsilon^2/2$). On the contrary, if work is done on a stationary object ($m\upsilon^2/2$), it can only accelerate the object to a velocity of ($\upsilon/\sqrt{2}$), and the object ultimately has kinetic energy of ($m\upsilon^2/2$). This has been proven during the launch of spacecraft: the launch velocity calculated according to the work-kinetic energy theorem can only reach ($1/\sqrt{2}$) of the escape velocity, which is the first cosmic velocity of 7.9 km/s. Multiply by $\sqrt{2}$ again to reach escape velocity:

7.9 km/s × ($\sqrt{2}$) = 11.2 km/s (second cosmic velocity)

By the above analysis, it can be seen that it is quite difficult to distinguish between two types of kinetic energy in theoretical physics. We can see that nearly two hundred years ago, Coriolis accidentally dug a very large mechanical and philosophical trap for future theoretical physicists.

Hamilton Falling into a Trap

The famous mathematician and physicist who first dropped into the Coriolis kinetic energy trap was William Rowan Hamilton of England (1805-1865). He mistakenly introduced the formula of Coriolis kinetic energy into theoretical physics and developed analytical mechanics. In 1834, Hamilton published the historic paper "On a general method in dynamics", establishing the famous Hamiltonian principle [12]. Hamilton did not distinguish between the two types of kinetic energy, but wrote kinetic energy as the ratio of the square of momentum (P) to twice the mass, i.e. $P^2/(2m)$. In fact, $P=m\upsilon$, $P^2/2m=m\upsilon^2/2$, which is exactly the same kinetic energy formula used by Coriolis in engineering. Coriolis kinetic energy is not suitable for solving uniform motion problems. Hamilton indiscriminately established the energy relationship of particles in the potential energy $V(q)$

$$H = \frac{P^2}{2m} + V(q) \qquad (11)$$

where H is the total energy of the particle, and q is the coordinate of the particle. Later, equation (11) was also used to solve the Kepler problem. Hamilton's in-depth research and development of analytical mechanics, as well as his high fame at that time, inadvertently paved the way for the Coriolis kinetic energy trap. Schrödinger fell into the Coriolis kinetic energy trap along the Hamiltonian path, and equation (11) is the energy relationship equation (1) used by Schrödinger. Since Hamilton, the law of conservation of energy in physics has still been expressed as

Mechanical Energy (Or Total Energy) = Kinetic Energy + Potential Energy,

or Kinetic Energy + Potential Energy = Constant.

We not only need to ask, for the orbital motion of celestial bodies or the rotational motion of electrons within stationary atomic molecules, which neither does work on the external bodies nor is done work by external forces, it is definitely an energy conservation system. So, what is the mechanical energy of such an energy conservation system? Is there still mechanical energy in these systems? The laws of nature follow the simplest way. If we use Leibniz kinetic energy or centrifugal kinetic energy in theoretical physics, the law of conservation of energy can be expressed as follows: the orbital potential energy of an object undergoing periodic rotational motion is equal to Leibniz kinetic energy, or Leibniz kinetic energy + potential energy = 0.

Bohr Model and its Half Frequency Difficulty

Bohr established his model of the hydrogen atom in 1913 based on the assumption of quantization [13]. His model is based on classical mechanics and does not use chaotic energy relationships. His mechanical relationships are clear, and if applied to Kepler problems, there would be no errors. In atoms, compared to Coulomb's force, universal gravitation can be completely ignored. Bohr established the mechanical equation that Coulomb's force is equal to centrifugal force as centripetal force,

$$\frac{ke^2}{r^2} = \frac{m\upsilon^2}{r} \qquad (12)$$

Based on Bohr's quantization hypothesis and quantization condition ($m\upsilon r_n=nh/2\pi$), and combined with Einstein's photon energy formula ($E=h\nu$), we multiply both sides of equation (12) by r^2 to obtain

$$ke^2 = m\upsilon^2 r = (m\upsilon r_n)\cdot\upsilon = \frac{nh}{2\pi}\cdot(\omega_n\cdot r_n) = nh\cdot\frac{\omega_n}{2\pi}\cdot(na_0) = n^2 a_0 h\nu_n = n^2 a_0 E_n$$

or

$$E_n = \frac{ke^2}{n^2 a_0} \qquad (13)$$

When an electron transitions from energy level n_2 to energy level n_1, the energy of the radiated photon is

$$\begin{aligned}\Delta E &= E_{n2} - E_{n1} = (\frac{1}{n_1^2} - \frac{1}{n_2^2})\cdot\frac{ke^2}{a_0} = \\ &= (\frac{1}{n_1^2} - \frac{1}{n_2^2})\cdot\frac{8.99\times10^9\times(1.60\times10^{-19})^2}{5.3\times10^{-11}} = \\ &= (\frac{1}{n_1^2} - \frac{1}{n_2^2})\times 4.34\times10^{-18}\ (\mathrm{J})\end{aligned} \qquad (14)$$

The photon frequency is

$$\begin{aligned}\nu &= \frac{\Delta E}{h} = (\frac{1}{n_1^2} - \frac{1}{n_2^1})\cdot\frac{4.34\times10^{-18}}{6.626\times10^{-34}} = \\ &= (\frac{1}{n_1^2} - \frac{1}{n_2^1})\times 6.6\times10^{15}\ (\mathrm{s^{-1}}),\quad n_2 > n_1\end{aligned} \qquad (15)$$

Bohr claimed in his 1913 article that he derived the expression for the empirical Rydberg constant R using ordinary physical constants.

The Rydberg constant is a constant in the empirical formula for calculating the wavelength of spectral lines in the Balmer system of hydrogen atoms

$$\tilde{v} = \frac{1}{\lambda} = \mathrm{R}(\frac{1}{2^2} - \frac{1}{n^2}), \quad n = 3, 4, 5, \ldots ,$$
$$\mathrm{R} = 1.096776 \times 10^7 \ \mathrm{m}^{-1} \qquad (16)$$

To compare with Bohr's equation (15), we derived the Rydberg frequency suitable for the Balmer system from equation (16)

$$v = \tilde{v} \cdot c = \frac{c}{\lambda} = c\mathrm{R}(\frac{1}{2^2} - \frac{1}{n^2}) =$$
$$= (\frac{1}{2^2} - \frac{1}{n^2}) \times 3.3 \times 10^{15} \ (\mathrm{s}^{-1}); \ n = 3, 4, 5, \ldots , \qquad (17)$$

By comparing equations (15) and (17), obviously, the frequency obtained by Bohr is twice the frequency of the Rydberg experiment, which means that his frequency formula can only be consistent with the experiment by multiplying it by a factor of 1/2. Bohr spent a considerable amount of space in his first article in 1913 attempting to explain and address this half frequency problem. Although he later introduced the principle of correspondence to explain it, none of them were successful. Eventually, it became the half frequency problem that Bohr never solved throughout his life [14,15].

Today, let's look back and see why the Bohr model has a half frequency problem? Although Bohr used the Coriolis kinetic energy T in his article, he expressed the formula for centrifugal force (F) using $2T/r$. Where $2T$ is still equivalent to Leibniz kinetic energy. In terms of mechanical relationships, it is still equal.

$$F = \frac{2T}{r} = \frac{2 \times \frac{1}{2} m\upsilon^2}{r} = \frac{m\upsilon^2}{r}, \qquad (18)$$

When both sides of equation (12) are multiplied by r, the energy relationship got is consistent with the force relationship used by Bohr. Therefore, Bohr did not use Hamilton's chaotic energy relationship, that is, he did not fall into the Coriolis-Hamilton energy trap. It is correct to ignore universal gravitation in the study of atomic structure, but Bohr's mistake is that he ignored Lorentz force, which is equivalent in magnitude to Coulomb force.

The Coulomb force is $F_1 = ke^2/r^2$, and the Lorentz force is $F_2 = q(\upsilon \times B)$. Coulomb force does not depend on the motion of electric charges, and Lorentz force does not depend on the existence of nuclear charges. When the two forces exist alone, they both reach equilibrium with the centrifugal force of electrons. When the two forces coexist, they are equal and reach equilibrium with centrifugal force together, that is

$$F_1 + F_2 = 2F_1 = 2F_2 = \frac{m\upsilon^2}{r}; \ \text{or}$$
$$\frac{2ke^2}{r^2} = \frac{m\upsilon^2}{r}; \ \text{or} \ \frac{ke^2}{r} = \frac{1}{2} m\upsilon^2 \qquad (19)$$

Due to the coexistence and equality of Coulomb force and Lorentz force in atoms, the coincidental result is that the potential energy of electron orbital motion is equal to the Coriolis kinetic energy. Comparing equation (19) with Bohr's equation (12), in fact, Bohr did not consider the Lorentz force, which decreased 1/2, and Schrödinger mistakenly used Coriolis kinetic energy, which increased 1/2. This is just a wrong coincidence. But in the Bohr model, equation (19) cannot be derived from his equation (12). Equation (12) differs from Equation (19) by a factor of 1/2 and is irreconcilable.

The Bohr model did not use the chaotic Hamiltonian energy relationship, as stated by Bohr in [Absorption of Radiation] that his formula is the same as Einstein's derivation in the photoelectric effect, that is, $T = h\nu - W$, where T is the kinetic energy of the emitted electrons and W is the total energy emitted by the electrons during the initial binding process [13]. Obviously, in the electronic steady state without photon emission or absorption, there is $T = -W$, which is the same as the energy relationship equation got by formula (12).

The Bohr Model is Consistent with De Broglie's Concept of Matter Waves

In the ground state hydrogen atom, electron and proton rotate in the same direction around their common center of mass. On the circular orbit of the electron, there is the strongest negative electric field near its instantaneous position. The transient electromagnetic field of electron is in phase with the motion of electron, and of course has the same period, which is consistent with de Broglie's original idea [4]. The mass of a proton is 1836 times that of an electron, so the orbital radius of a proton is only 1/1836 of that of an electron. The transient positive electric field of a proton forms a positive periodic electromagnetic wave along the small circular orbit of the proton, which has the same period and corresponding phase as the large circular orbit of the electron. Two circular periodic oscillation waves with opposite electric field signs couple with each other and converge at the atomic boundary. Of course, the convergence interface cannot be a smooth sphere. However, over a longer period of time, its average effect can be considered as a sphere. As a result, for each steady-state orbit, hydrogen atoms do not radiate electromagnetic waves outward.

The Schrödinger Equation cannot be Separated from the Bohr Model

The quantization conditions used in the Bohr model and the Bohr radius calculated by Bohr are the basis for the Schrödinger equation to handle hydrogen atoms. Bohr believed that orbital angular momentum is quantized, and Bohr's quantization condition is $m\upsilon r = h/2\pi$. That is to say, Schrödinger introduced the constant $K = h/2\pi$ in his equation (1″) was the Bohr's quantization condition. If this quantization condition is not introduced, Schrödinger cannot obtain the quantized energy level formula.

By equation (3), it can be seen that Schrödinger's radial wave function contains a natural exponential term ($-r/a_0$). This indicates that Schrödinger assumed the Bohr model and directly quoted the results of the Bohr model without any derivation or proof. If Bohr radius is not used, his exponential term and even his entire radial wave function have no physical meaning.

The Schrödinger Wave Equation contradicts de Broglie's standing Wave Theory

My other article [7] has already proven that in following de Broglie matter wave formula,

$$\lambda = \frac{h}{p} = \frac{h}{m\upsilon} \qquad (20)$$

λ is equal to the circumference of the Bohr circular orbit in the ground state hydrogen atom, $\lambda = 2\pi a_0$. The de Broglie waves are standing waves, with each excited state wavelength being an integer multiple of the ground state wavelength. Comparing $\lambda_n = 2\pi r_n$ with $m\upsilon r_n = nh/2\pi$, we obtain that $r_n = na_0$. Therefore, the orbital radius of hydrogen atoms is quantized, and the orbital radius of each excited state is an integer multiple of the ground state radius. According to Bohr and de Broglie's ideas, orbital

radius, orbital angular momentum, and energy are all quantized. Their excited states are all integer multiples of the ground state values. Obviously, the wave equation established by Schrödinger does not conform to de Broglie's standing wave principle. He cannot make the radius, angular momentum, and energy all exhibit integer fold changes. He only retained integer multiples of energy levels in the Bohr model. At the beginning of his 1926 article [2], Schrödinger declared that he had changed the rule of integer multiples for quantization. He wrote in German

In dieser Mitteilung möchte ich zunächst an dem einfachsten Fall des (nichtrelativistischen und ungestörten) Wasser-stoffatoms zeigen, daβ die übliche Quantisierungsvorschrift sich durch eine andere Forderung ersetzen läβt, in der kein Wort von „ganzen Zahlen" mehr vorkommt. Vielmehr ergibt sich die Ganzzahligkeit auf dieselbe natűrliche Art, wie etwa die Ganzzahligkeit der *Knotenzahl* einer schwingenden Saite. Die neue Auffassung ist verallgemeinerungsfähig und rűhrt, wie ich glaube, sehr tief an das wahre Wesen der Quantenvorschriften.

Translated into English: "In this article, I first want to explain that in the simplest case of a hydrogen atom (non relativistic and undisturbed), the usual quantization rules can be replaced by another demand, in which there is no longer the word 'integer'. On the contrary, the result of integers is the same as the natural way of counting integer nodes in vibrating strings." Schrödinger's "demand" was a compromise in which his equation was powerless against the quantization rules of integer multiples.

Incorrect Introduction of Radial Function

According to the de Broglie wave formula $\lambda = h/(m\upsilon)$, for the ground state hydrogen atom, λ is a standing wave, its wavelength is a constant, and h is also a constant, so the momentum $m\upsilon$ must also be a constant. According to the quantization condition $m\upsilon r=h/(2\pi)$, the orbital radius r must also be constant. Therefore, only circular orbits like Bohr's are suitable. The orbital radius of each excited state is quantized and is an integer multiple of the ground state radius. So, these orbital radii are some discontinuous, specific separation values. The Schrödinger equation introduces a continuously changing radial distribution function when separating variables. If not used the Bohr radius, this radial distribution function cannot obtain a physically meaningful solution, and cannot obtain integer multiples of the quantization radius.The introduction of the radial distribution function into the Schrödinger equation is incorrect.

Falsified Orbital Angular Momentum

The orbital angular momentum $m\upsilon r =h/2\pi$ of the ground state hydrogen atom is referred to as the quantization condition by Bohr. For the nth energy level, $\lambda_n=nh/2\pi$. In the Schrödinger equation, the quantization condition is introduced in the form of a constant K. If the quantization condition is not used, he cannot obtain the Bohr energy level formula. K is used in the (1″) equation in his 1926 original text [2]. He wrote in German:

"**Es** ergeben sich also die wohlbekannten Bohrschen Energieniveaus, die den Balmertermen entsprechen, wenn man der Konstante ***K***, die wir in (2) aus dimensionellen Gründen einführen muβten, den Wert erteilt".

Translated into English: "Therefore, if we give a value to the constant K, we will obtain the famous Bohr energy level corresponding to the Balmer term. Due to dimensionality, we have to introduce the constant K in (2)." In his article (but not in this article), his equation (20) provides the expression for K, $K=h/2\pi$. In fact, his constant is the orbital angular momentum value of the ground state hydrogen atom. Why isn't Schrödinger called orbital angular momentum, or not expressed as $m\upsilon r$? Because his equation ultimately cannot solve for simple orbital angular momentum that varies in integer multiples. His orbital angular momentum L is represented by the angular quantum number l, that is,

$$L = \sqrt{l(l+1)}\cdot\hbar, \quad l = 0, 1, 2, \cdots n-1; \tag{21}$$

For the ground state hydrogen atom, if n =1 and l=0, then L=0. The Schrödinger equation yields a ground state orbital angular momentum of 0, which does not comply with the quantization rule. Because according to the quantum rule, the orbital angular momentum of the excited state is an integer multiple of the ground state. If the orbital angular momentum of the ground state is zero, then the orbital angular momentum of all excited states is zero. The Schrödinger equation cannot obtain orbital angular momentum with non-zero ($m\upsilon r = h/2\pi$) for ground state, but this orbital angular momentum is necessary for his equation. He had to forcefully pull the constant K into his equation. Therefore, the orbital angular momentum equation (21) obtained from the Schrödinger equation does not conform to the law of quantization variation.

Hidden Electronic Velocity

Substituting the quantization condition ($m\upsilon r = h/2\pi$) into equation (13), it is evident from the Bohr model that the electron velocity is a constant

$$ke^2 = m\upsilon^2 r = m\upsilon r\cdot\upsilon = (h/2\pi)\cdot\upsilon;$$
$$\upsilon = \frac{2\pi ke^2}{h} \tag{22}$$

In 1916, Sommerfeld's paper obtained $\upsilon = \alpha c \approx c/137$, or $\alpha = \upsilon/c$. Here, α is called the fine structure constant. Although the existence of the fine structure constant has been widely confirmed in all fields of atomic and molecular spectroscopy, modern quantum mechanics does not recognize this Sommerfeld relationship. Because if the Sommerfeld relationship, the electron velocity υ, electron momentum p, and electron kinetic energy T are acknowledged to be all constants, the physical basis for establishing the Schrödinger equation is lost. And the magnificent building built on the basis of the Schrödinger equation in the early 20th century collapsed instantly. Therefore, the first security task of the maintainers of the Schrödinger equation is theoretically not to recognize the Sommerfeld relationship and not to recognize that electron velocity is a constant. Their specific approach is to hide the velocity variable method, hiding velocity into momentum p, representing kinetic energy into $p^2/2m$.

Now let's analyze why the electron velocity in atoms remains constant? The main forces acting on electrons in atoms are Coulomb force and Lorentz force. The Coulomb force from the nucleus only provides centripetal force for electrons and does not change their velocity. Lorentz force only provides centripetal force for moving electrons, which can change the direction of velocity but not the magnitude of velocity. That is to say, Coulomb force and Lorentz force only change the curvature radius of electron motion, without changing the electron velocity.

When electrons absorb radiation during the transition process, photons are transverse waves that only change the orbital radius of electrons in the direction perpendicular to the incident light, but do not change the velocity of electrons. That is to say, only

changing the rotation frequency of electrons, resulting in the photon frequency being proportional to the rotation frequency of electrons $E=hv$, becoming the photon frequency directly related to the electron rotation frequency. Although photons have momentum, their momentum not only acts on electrons, but also on positively charged atomic nuclei. The momentum of photons and the momentum of the entire atom follow momentum conservation. So, photon momentum does not change electron velocity. I have already analyzed the details of electron absorption of photons in detail in my 2021 article [16].

The voltage applied between the positive and negative electrodes of the cathode emitter tube only amplifies the curvature radius of electrons from the atomic scale to the macroscopic scale. The Large Electron Collider is always designed with a circular acceleration path, which means that electrons are still not traveling in a straight line, but rather much straighter than their starting point path. The higher the applied voltage, the straighter the electron path. When the electronic path is straighter, the probability of collision increases. In quantum circuits, electrons always shift to one side, indicating that they still maintain curved motion. The change in electron velocity may be accompanied by the speed of light in vacuum, and only varies with the age of the universe [17]. At present, when the age of the universe remains approximately constant, the speed of light, the speed of electrons, and their ratios can certainly be regarded as constants. Perhaps only during the beta decay process, the velocity of electrons increases with the increase of the orbital radius around the nucleus. Because the frequency of electron rotation remains constant during this process. Only by setting aside the Schrödinger equation can we understand the physical meaning of the fine structure constant.

Incorrect Use of Calculus

In my recent article "A Rydberg Bohr de Broglie Algebraic Model of Hydrogen Atoms", the title highlighted "Algebraic Model" [7]. The Bohr model is an algebraic model, and the modified Bohr model by the author is still an algebraic model. Algebraic models are suitable for various steady-state solutions of hydrogen atoms. Without Bohr's assumption, the quantum orbital radius, orbital angular momentum, energy levels, and a series of quantum numbers of the hydrogen atom can also be obtained using de Broglie's standing wave theory. During each transition of an electron, it needs to spin tens of millions of times around the nucleus. During this period, the orbital radius, orbital angular momentum, energy, and even quantum numbers all undergo continuous changes. Continuous processes are suitable for calculus calculations. Why can't the Schrödinger equation handle the absorption and radiation processes of photons, resulting in the lack of mechanisms for photon absorption or radiation to this day? Steady state is quantized and has discontinuity; Transition is a continuous change. Schrödinger applied calculus to the former, not the latter, so it cannot solve the problems of photon absorption and radiation.

In recent years, I have published multiple papers that have bypassed the Schrödinger equation and established new quantum systems. In all theoretical discussions of these atomic structures, all formula derivations are smooth, coherent, and the underlying logic is clear. The electron mass, electron velocity, and electron momentum are all expressed as constants, and the electron velocity is consistent with Sommerfeld's derivation in 1916. And it is evident that the β - factor effect proposed by relativity, which affects time and length as mass increases with velocity, has not been discovered. A hundred years ago, it was eliminated by history due to the contradiction between classical mechanics theory and atomic steady state. Today, the Schrödinger equation also contradicts the stable existence of electrons in atoms, and its future is evident. If Einstein's spirit in heaven had read this article, he would have pointed out that the Schrödinger equation is more of a real witchcraft calculus and its complexity has ensured that it has not been proven wrong for nearly a century.

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