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The Life of Human Beings to Know Nature and Understand Themselves—Commemorating the 136th Anniversary of the Birth of Schrödinger, the "Legislator" of the Microcosm

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Abstract: *Schrödinger is a great figure in the history of physics development in the 20th century and one of the founders of quantum mechanics. In this paper, by consulting relevant literature, the Schrödinger equation proposed by Schrödinger is used to describe the state of motion of microscopic particles. He has made great contributions to the development of quantum mechanics, and it is the first time to express the volatility of particles in the form of specific formulas. The Schrödinger equation is important in the microscopic world and is close to the position of Newton's laws of motion in classical mechanics. I use this article to commemorate the 136th anniversary of the birth of the "legislator" Schrödinger of the microcosm.*

Keywords: *quantum mechanics, history of science, microscopic wave mechanics*

1. Introduction

Planck points out that the Schrödinger equations laid the foundation of modern quantum mechanics, just as the equations created by Newton, Lagrange, and Hamilton played a role in classical mechanics. From Planck's high evaluation of Schrödinger's work, it is not difficult to see that Schrödinger and his wave equations play an important role in the development of quantum mechanics as a whole. The Schrödinger equation is the basic law observed by the motion of particles in the microscopic world, and its importance is the same as Newton's three major theorems of motion in classical mechanics[1].

2. Family Education and Ideological Enlightenment

Schrödinger (fig. 1, cited in literature [1], p. 65) was born into a small family of artisanal owners in Vienna, Austria. His father, Rudolf Schrödinger, ran an oilcloth factory. Although the craft is a little old, the business is still successful, allowing him to have financial peace of mind. Rudolph was a varied educator and loved the natural sciences and arts. As a friend, teacher and tireless conversation partner, sharing his lively and interesting spiritual life with his only child, Schrödinger, greatly attracted and influenced Schrödinger's childhood. The grandmother was British, so she was fluent in English from an early age. He even translated Homer's poems into English as a break in his intense research.

Figure 1: Schrödinger

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Schrödinger's entry into the physics faculty of the University of Vienna coincided with the death of Boltzmann, and he was impressed by the sad atmosphere of the school. He was also deeply attracted by Boltzmann's ideas on physics, and called Boltzmann's line of thought his first love in science. Hazenor was a student under Boltzmann and later took over as Boltzmann to give lectures on theoretical physics. Schrödinger was also very interested in Hazenauer's lectures, which involved eigenvalue theory that was the key to the subsequent establishment of wave dynamics theory. In addition, he listened to Winttinger's lectures on mathematics and Exner's lectures on experimental physics, both of which inspired Schrödinger and became the germ of many of his later ideas[2-3].

3. Architect of the Quantum Mechanics Building

3.1 Milestone in the development of quantum theory - Bohr theory

Niels Henrik David Bohr, starting from atomic stability and spectral formulas, abandoned classical electromagnetic theory. For the first time, he combined Planck's quantum theory with Rutherford's model of nuclear structure. In addition, several hypotheses were made and Bohr's theory of atomic structure was given. This theory can not only explain the problem of intermolecular stability and the problem of line spectrum between hydrogen atoms and hydrogen-like atoms, but also lays a solid theoretical foundation for the extension of Sommerfeld's quantized orbit to ellipse and the fine structure constant. However, Bohr's theory is only a hodgepodge of classical theory and quantum theory, lacking conceptual self-consistency and logical consistency. Although the correspondence principle was proposed, attempts to use classical theory as the limit of quantum theory to explain the Stern-Gallach effect, the interaction between atoms, and other problems that could not be explained by quantum theory were unsuccessful. Therefore, Bohr's theory is only a semi-classical and semi-quantized transitional theory to a certain extent, and it needs to be continuously improved.

3.2 A new stage in the development of quantum theory - de Broglie's phase wave theory

Schrödinger once confessed that what drove his work was de Broglie's theory of volatility. Both he and de Broglie firmly believed in the objective truth of phenomena and insisted on using the concept of classical probability to explain problems. In 1924, de Broglie proposed that the motion of matter particles (especially electrons) must be accompanied by a hypothetical phase wave whose frequency is determined by $E = h\nu$. The conditions for quantization can be derived from the resonance of the phase wave, and the electron beam is diffracted through the hole. The interaction between the old and new mechanics of free particles is similar to the interaction between wave optics and geometric optics. The peculiarity of phase wave theory is that it combines waves and particles, which Einstein called an interesting attempt.

3.3 Schrödinger became famous in one fell swoop - the wave equation came out

Inspired by de Broglie's phase wave theory, Schrödinger experienced difficulties in refraction by processing orbital electrons as running waves, to success in using ideal gases as phase wave resonances. Then go back to the wave equation to find the electron standing wave to find the relativistic wave equation of the hydrogen atom, and solve the flat integer energy level that could not be explained at that time. Then find its non-relativistic approximation and solve the Bohr energy level. The well-known Schrödinger equation was established respectively by using the variational principle and Hamiltonian similarity.

The partial differential equation representation and easier to understand concepts used in Schrödinger's equations. The validity of the space-time description is retained in the form, and the overall framework has a simple and clear geometric beauty. Bohr 's quantization hypothesis can be used as eigenvalues to solve the effects on one-dimensional harmonic oscillators, fixed-axis and non-stator-axis rotors, diatomic molecules, and Stark.After waiting, the basic theoretical solution with the same experimental results can be solved. Matrix mechanics has also been shown to be mathematically equal to wave mechanics, which makes wave mechanics a complete system that integrates previous research, is more rigorous and self-consistent in theoretical research, and has more extensive and effective practical applications.The door of wave dynamics entered by Schrödinger and the door of matrix dynamics entered by Heisenberg are interconnected in the edifice of quantum mechanics. It's just located on a different side of the building of quantum mechanics[4-5].

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The Schrödinger equation is a partial differential equation that describes how the quantum states of a physical system evolve over time, so it is one of the fundamental equations of quantum mechanics. In classical mechanics, Newton's second law is used to describe the motion of objects. In quantum mechanics, a similar equation of motion is the Schrödinger equation. The solution of the Schrödinger equation fully describes the quantum behavior of microscopic particles in physical systems, such as molecular systems, atomic systems, and so on. The state of a microscopic system is described by the wave function, which is the differential equation of the wave function. Given the initial conditions and the conditions of the boundary, the wave function can be solved from this equation. In addition, the solution of the Schrödinger equation can fully describe macroscopic systems, and possibly the entire universe.

4. Although a late bloomer, but brave to innovate

4.1 Scientific work is not original, but good at construction

In fact, Schrödinger himself confessed that his research results were often not original, but he always keenly captured certain creative ideas. Coupled with systematic construction and development, it forms first-class ideas and theories. For example, wave dynamics references de Broglie's phase wave theory, “WHAT IS LIFE?” was inspired by Bohr and Delbrück, while "Schrödinger's Cat" was inspired by Einstein. Schrödinger once said that our task is not to discover something that others have not yet discovered, but to think about what everyone has seen before. This gives a great inspiration to newcomers who have just entered the door of scientific research - that is, dare to imagine, dare to borrow, stand on the shoulders of giants to see the world, it will be easier to discover new things.

4.2 Jump out of the old theoretical framework and build a wave dynamics system

Compared with other well-known figures in the history of quantum mechanics, Schrödinger can be described as a late bloomer. When the first article that made him famous was published, Einstein was 26 years old, Bohr was 28 years old, Heisenberg was 24 years old, Pauli was 25 years old, Dirac was 24 years old, about 23 years old, and Schrödinger was 39 years old by this time. At this point in the year, it is indeed not easy to jump out of the existing old theoretical framework and make such a huge development on the new ideological line. And it is precisely because of his theoretical literacy and knowledge accumulation in previous scientific research work that he has established a wave mechanics system that summarizes the theoretical and practical results of previous work in less than half a year[6-7].

4.3 Devoted his life to the unity of science

Schrödinger's lifelong ideal and goal was the great unity of science. In the field of modern physics, he worked on the combination of relativity theory and quantum mechanics and synthesized the grand unified field theory of various properties. Because of his interest in the mysterious status of existence, especially the invariability of biological genetic characteristics and the study of biological metabolism, and the use of new achievements and technologies in the field of modern physics to analyze the evolution of modern life, he is the author of "WHAT IS LIFE?".

5. Conclusion

Schrödinger's success lies not only in his ability to introduce wave equations to describe the motion of particles, but also in his courage to break the old theoretical framework and believe in the objective reality of phenomena. And good at finding breakthroughs in existing scientific work for effective innovation. His love for scientific research and his spirit of exploration are worthy of our learning and respect.

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