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Equation of Schrodinger's wave

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***Abstract*---**The Schrodinger equation is a quantum physics partial differential equation used to determine the wave function and energy of atomic and molecular systems. It is a non-relativistic phenomenological equation that is solved to acquire insight into the qualities of a physical system. Calculation of an infinite set of linked integrodifferential equations is required in the general situation [3]. He found the electron in 1897, and that led to a model of an atom that had protons and electrons that had different charges. An experiment done by Ernest Rutherford and others in 1911 found that the positive charge in an atom was concentrated in space much smaller than the size of the atom itself. This is what they found. This led to a picture of the atom as a small solar system with a big, positively charged nucleus and a group of electrons that move around it all the time [4].

***Keywords*---**integrodifferential, equations, intensity.

Introduction

Max plane came up with a way to explain how electromagnetic radiation from a black body was spread out in 1900. He said that electromagnetic radiation could be thought of as particles. If the frequency of the radiation is v, then the energy E is equal to the frequency of the radiation, which is

$$E = h\nu \tag{3.1}$$

Where h is the constant of the plank. This is how it works: Use the plank's hypothesis to explain how light made a metal like sodium give off electrons, like when it was hit by light [12]: He said that he thought the speed of the electrons that were emitted was directly related to how often they were emitted, and that the intensity of the light only changed how many electrons were emitted. Einstein

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said that the energy of light doesn't spread out through the wave, as classical electrodynamics would say, but is concentrated into photons of energy hv. When an electron on the surface of a metal is hit by a photon with a higher energy than the energy that binds the electron to the metal, it emits an electron.

Niels Bohr then used the ideas from the Rutherford experiment and the quantum theory of plank and Einstein to make the first quantitative model of the atom. Bohr thought that electrons could only move in circles, and more specifically, that they could only move in circles. A plank constant divided by 2 is called a "plank orbit." The angular momentum of an electron moving in a circular orbit is the product of its momentum p and its radius. Only those orbits for which this was the case are called "plank orbits." If you look at classical electromagnetic theory, Bohr said that electrons had the same total energy when they were moving around the proton in one of their allowed orbits. He said that when they moved from one allowed orbit to another, they radiated energy. Bohr worked out that a spectral transition in hydrogen could happen with the emission of light with a certain frequency. This is what he came up with.

$$V = \frac{EmEn}{ch} \tag{3.2}$$

Where c is the speed of light, Em and En are the two states that are in between. There are more frequencies that can be used when the value for energy level is changed in this expression.

$$V = R_u\left(\frac{1}{n^2} - \frac{1}{m^2}\right) \tag{3.3}$$

Using the Rydberg constant, this expression matches an empirical formula for the hydrogen spectrum lines, where n is 1, 2, 3, 4, and 5. This corresponds to the number of lines in each of the four groups of lines. Louis de Broglie thought that the electron was like a wave, with a wave length of l, that had a lot of momentum because of its relationship to other things.

$$\lambda = \frac{h}{p} \tag{3.4}$$

The way electrons and photons move in waves is the same way that electromagnetic radiation moves in waves, so this is why. This idea was confirmed by a series of experiments by Clinton J. Davisson and Lester H. Germer, who showed that diffraction experiments can be done with a beam of electrons in the same way that they can be done with light. [7] De Broglie said that the Bohr orbits around a circle with a circumference that is equal to the number of wave lengths. It was in 1926 that Erwin Schrodinger came up with a partial differential equation that explained how electrons move in waves. The equation is now known as the Schrodinger equation. Schrodinger found that those solutions where the amplitude, or size, of the wave function stayed the same around the nucleus predicted for the electron a set of possible energies. This is what he found. When the Bohr Theory was made, it said that these were the same things that would happen There is a way to figure out how likely it is that an electron will be at a given point in space and time when a measurement is made, according to Max Born. Take a look at how photons move in an electromagnetic field. Waves move in the same way that waves move according to Maxwell's equation.

$$\frac{d^2A}{dx^2}+\frac{d^2A}{dy^2}+\frac{d^2A}{dz^2}=\frac{1}{c^2}\frac{d^2A}{dt^2} \tag{3.5}$$

It doesn't matter where a photon is, but the probability that one will be found at any point is the square of the amplitude at that point, which is A. Phonon energy is linked to the frequency of wave motion by Einstein's equation (3.1), and the momentum of a photon is given by equation (3.2). This is how it works (3.4). If the Einstein relation is also true for electron waves, then the speed of the wave is the same as the speed of light.

$$V=\lambda\upsilon=\frac{E}{p} \tag{3.6}$$

When a wave moves, its differential equation is called

$$\frac{d^2\phi}{dx^2}+\frac{d^2\phi}{dy^2}+\frac{d^2\phi}{dz^2}=\frac{1}{c^2}\frac{d^2\phi}{dt^2}=\frac{p^2}{E^2}\frac{d^2\phi}{dt^2} \tag{3.7}$$

where ϕ is the amplitude of the electron wave. For a solution that represents standing waves ϕ may be written in the form.

$$\phi=\phi_{\exp}(-2\pi i v t) \tag{3.8}$$

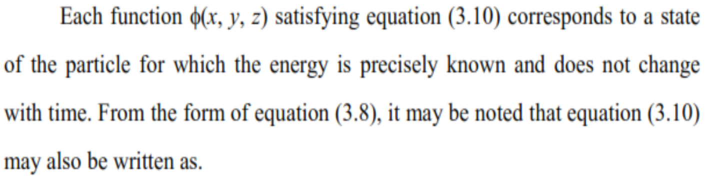
Where ϕ is a function of the Cartesian co-ordinates x, y and z but not of time t. For a probability of finding the electron at a point to be real and positive the square of the absolute value ϕ must be taken substituting equation (3.8) in the equation (3.7) gives.

$$\frac{d^2\phi}{dx^2}+\frac{d^2\phi}{dy^2}+\frac{d^2\phi}{dz^2}=\frac{-4\pi^2p^2}{h^2}\phi \tag{3.9}$$

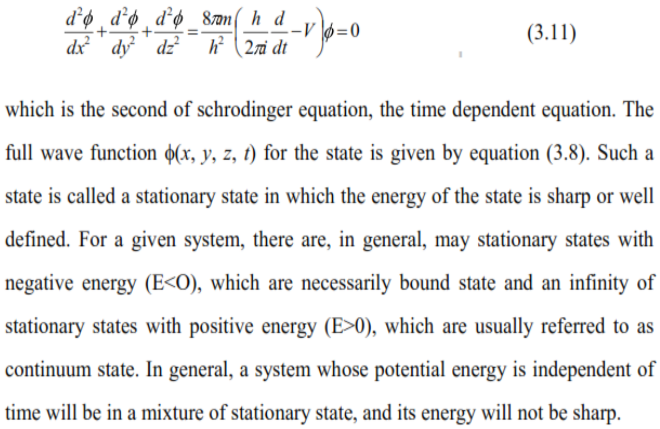
as the differential equation for ϕ, the kinetic energy of the electron is $T=E-V$ where V is the potential energy, is connected with the momentum by the relation $T=p^2/(2m)$ where m is the mass of the electron. Thus equation (9) may be written as.

$$\frac{d^2\phi}{dx^2}+\frac{d^2\phi}{dy^2}+\frac{d^2\phi}{dz^2}=\frac{8\pi^2m}{h^2}(E-V)\phi=0 \tag{3.10}$$

One of Schrodinger's equations is called the time-independent equation, and this is the first one. Most applications of non-relativistic quantum mechanics use this equation to do so.



Each function $\phi(x, y, z)$ satisfying equation (3.10) corresponds to a state of the particle for which the energy is precisely known and does not change with time. From the form of equation (3.8), it may be noted that equation (3.10) may also be written as.



$$\frac{d^2\phi}{dx^2}+\frac{d^2\phi}{dy^2}+\frac{d^2\phi}{dz^2}=\frac{8\pi m}{h^2}\left(\frac{h}{2\pi i}\frac{d}{dt}-V\right)\phi=0 \qquad (3.11)$$

which is the second of schrodinger equation, the time dependent equation. The full wave function $\phi(x, y, z, t)$ for the state is given by equation (3.8). Such a state is called a stationary state in which the energy of the state is sharp or well defined. For a given system, there are, in general, may stationary states with negative energy (E<O), which are necessarily bound state and an infinity of stationary states with positive energy (E>0), which are usually referred to as continuum state. In general, a system whose potential energy is independent of time will be in a mixture of stationary state, and its energy will not be sharp.

In 1925, Warner Heisenberg came up with the first version of quantum theory. This led to a formulation in which the observables are represented by matrices, which is how we now think about it. It is exactly the same as the Schrodinger time-dependent wave function formulation used by matrix mechanics. There is a common abstract-vector-theory skeleton in all of them. One-electron hydrogenic atom system: An electron of charge - e moves around the nucleus of charge +ze - can be solved exactly. This is how it works: The schrodinger equation for the problem can be reduced to that of a central force problem, and then it can be used to solve the problem, Those are the energy eigen values[14].

$$E_n=-\frac{hcR_H z^2}{n^2} \qquad (3.12)$$

Energy levels of the hydrogen-like atom are degenerate if the quantum number, n, is an integer. This is because more than one state corresponds to a specific value of the number. People who live in these "degenerate" states have extra quantum numbers l and m, which are linked to the spherical harmonic of the wave function. Even though you can describe the Hamiltonian for a more complex system than hydrogen, you can't solve the Schrodinger equation for that system to get its wave function, which is what you need to know. An important goal in the solution of Schrodinger's equation is to make sure that the results are accurate but also that you can understand them. Most of the time, scientists have used some kind of orbital approximation to figure out how the electronic states of a system are made up of just one electron orbital.

It is important to solve the many electron schrodinger equation for more complex atoms that have a lot of electrons. When an electron moves, it moves with the other electrons that it interacts with. One way to come up with a solution is to think of the electron electron interaction as a small change. One calculation can be used to make an entire electronic sequence. This is because the non-relativistic Z – 1 expansion of atomic energies can be used. When there are a lot of electrons, a simple way to make things easier is to think about each electron as an independent particle and move in the same direction as the other electrons. To figure out the energy levels of complex things like atoms, Douglas R Hartree used a method called self-consistent field. Hartree and Vladimir Fock improved this method by mentioning that spin pairs could happen.

There is more work to do to solve the Schrodinger equation for molecules, than there is to solve the equation for atoms. In fact, though, Born and J. Robert Oppenheimer came up with an approximation that lets us look at the movement of the molecular electrons separately from the movement of the nuclei. This approximation doesn't work in a lot of cases, and it doesn't work for both solids and molecules. Wave functions are made that show how electrons move. Keeping the nuclei in the same place in space so that the electrons don't move around as much as they would if they were moving around. Then, the movement of the nuclei is thought of in a smeared out negative charge density for a certain electronic state in the space around the nuclei [2].

Conclusion

Generalization of the Schrodinger equation: In 1928, P.A.M. Dirae came up with a new equation that took into account special relativity. Dirae found that this equation required the electron to have its own spin12. Schrodinger's non relativistic theory says that all material particles move at very slow speeds. This assumption is not true in the Dirae equation[6].

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