ESSAY 27: THE QUANTUM FORCE EQUATION

The classical equation of force being mass times acceleration is probably among the best known in science. However, there was no equation of force in quantum mechanics, the Schroedinger equation is a development of the classical hamiltonian, the sum of kinetic and potential energies. The development is that of the classical momentum into a differential operator, and this was carried out by Schroedinger during a search for a wave equation for the electron. So the Schroedinger equation is a pure energy equation. The quantum mechanical equation of force was discovered as a result of the quantum Hamilton equations described in essay 26 and UFT 172 onwards (www.aias.us). The equation was discovered by differentiating both sides of the Schroedinger equation and then by using Hamilton=s dynamics, in which the canonical variables of position x and momentum p are independent. The independence of x and p is a key step in deriving the quantum force equation. The great advantage of the equation is that it uses known wave functions and known energy eigenvalues.

The quantum force equation produces eigenvalues of force for the first time in the history of quantum mechanics, so the force equation has unlimited applicability in the same way that Newton=s force equation has unlimited applicability. In UFT 177 the force equation is fully tested with known solutions of the Schroedinger equation and with the use of computer algebra to remove human error from the complicated calculations. The Schroedinger equation can be solved exactly in some simple cases such as the harmonic oscillator. The latter is the name given to Hooke=s law, and it happens to be soluble analytically in quantum mechanics. This fact was discovered early on in the history of the subject. The energy levels or eigenvalues of total energy E for the harmonic oscillator are (n + 1 / 2) h bar omega, where n = 0, 1, 2, 3, ... , h bar is the reduced Planck constant and omega the angular frequency. It has the well known property of zero point or Avacuum@ energy, defined when n is zero, and this is a way of showing that energy can be tapped from the spacetime around us. This is sometimes called Azero point energy@.

The new force equation produces a profound and unexpected result, in that the eigenvalues of force are all the same, for every n they are F = - kx, the same as the classical result. Here k is the constant of Hooke=s law, and x is the spring displacement of Hooke=s law, in which the restoring, negative valued, force is proportional in the linear approximation to the length to which the spring is displaced. The wave functions of the harmonic oscillator can get to be very complicated, but despite this, the force eigenvalue or force level associated with every wave function is always - kx. This means that there is a zero point restoring force that does not exist in classical physics. It is known experimentally that there is a radiative correction known as the Casimir force, whose origins probably reside in the newly discovered zero point force, which has immediate application sin the urgent search for new energy. The harmonic oscillator has become a corner stone of quantum field theory, quantum electrodynamics and quantum optics, so this illustrates the unlimited applicability of the new quantum force equation.

In the early years of quantum mechanics it was discovered that the Schroedinger equation can be solved exactly for the H atom, in which there is a Coulombic attraction between the electron and proton. The method used was to consider the hamiltonian for H, the sum of the kinetic and potential energies, and to develop the momentum into a differential operator. This method should be properly known as Schroedinger=s axiom. The kinetic energy of the hamiltonian is p squared / (2m), so the operator is a second order differential. This procedure is the essence of quantum mechanics, and Hamilton came within a whisker of discovering it in the eighteen thirties. The force eigenvalues of H have been found to have a

completely different character from the force eigenvalues of the harmonic oscillator. The force eigenvalues are different for each orbital, and therefore provide a new and completely unexpected method of characterizing atoms and molecules in quantum mechanics. In UFT 177 some of them are plotted for atomic H. The force eigenvalue of the 1s orbital of H is zero, providing the first explanation of the stability of the 1s orbital. In the old quantum mechanics there was no explanation, because in 1s there is no centrifugal repulsion, the orbital angular momentum quantum number being zero. Therefore the 1s electron is drawn into the nucleus, and the most probable location of the 1s electron of H is the nucleus. This was a disaster for the old quantum mechanics, one which was not advertized, quite obviously. The new force equation shows that the 1s orbital is stable because the classical Coulomb force is counterbalanced by a hitherto unknown quantum force. The quantum force is non zero for all the other orbitals of H, and each orbital has it sown character, its own unique dependence of force eigenvalue on x.

This is a major discovery made simply, always the hallmark of true science. The discovery cost the taxpayer nothing at all but will benefit science immensely.