Essay 106: A New Schroedinger Equation

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The original Schroedinger equation was suggested by Peter Debye and given to his student Erwin Schroedinger to work out in detail at the University of Zurich in the mid twenties, about ninety years ago. Debye was interested in the then new wave particle dualism of Louis de Broglie, who proved that matter is particulate and undulatory, or particle like and wave like. Louis de Broglie based his ideas on the finite photon mass of Henri Poincare, suggested in 1905 in a paper to an Italian mathematical society.

Schroedinger came up with his famous solution by considering the hamiltonian, the sum of the potential and kinetic energies devised by my Civil List predecessor Sir William Rowan Hamilton of Trinity College Dublin in the nineteenth century. The classical hamiltonian is a sum of energies, so it is a scalar. Schroedinger's idea was to transform the kinetic energy into a differential operator which acted on a wave function. The potential energy remained classical and multiplied the wave function. On the classical level the hamiltonian is equal to the total energy, but Schroedinger made the hamiltonian into an operator that acted on the wavefunction to produce eigenvalues of the total energy. The total energy was therefore quantized and this procedure produced the de Brogle wave particle dualism and the Planck Einstein quantum theory.

When the Schroedinger equation was applied with a Coulomb law for potential energy, it produced the atomic orbitals. In the case of atomic hydrogen the solution of the Schroedinger equation can be worked out analytically, and the results agree very well with the main features of the spectrum of atomic hydrogen. It was later realized by Dirac that the fine structure can be described by the use of spinors and Pauli matrices. Spinors were inferred by Elie Cartan in 1913. It is now known from ECE theory that both the Dirac and Schroedinger equations are manifestations of the geometry developed by Elie Cartan and his co workers in the early twenties, the golden age of physics.

In recent work described in the preceding five essays and recent UFT papers, it has been realized that all orbits must be three dimensional. The precession of orbits is a manifestation of the fact that the orbit is three dimensional and that an orbit must be described by a kinetic energy based on the spherical polar coordinates and not on the plane polar coordinates of the four hundred year old dogma. The force of attraction between an orbiting mass m and a central mass M, the famous inverse square law, remains the same. The three dimensional hamiltonian is equivalent to the three dimensional conic section described in terms of an angle beta defined by the spherical polar coordinates. When the eccentricity is less than one and greater than zero, the conic section becomes the beta ellipse.

The beta ellipse is precisely equivalent to the three dimensional hamiltonian used in the original Schroedinger equation.

This realization leads as in UFT277 to a new type of Schroedinger equation which is exactly equivalent to the original Schroedinger equation but which gives new information, the expectation values of the cosine of beta. The quantized kinetic energy can be expressed in terms of beta of the spherical polar coordinate system. The new types of eigenvalues can be computed wherever the Schroedinger equation is used and this leads to a new type of computational quantum chemistry and quantum physics, providing a vast amount of new information using any type of computational procedure, for example ab initio computation and so on. Any material can be characterized by the new expectation values of the cosine of beta provided that its wavefunctions can be computed. In atomic hydrogen the wavefunctions are analytical but exceedingly intricate, so computer algebra is needed to compute the new expectation values in atomic H.

So major advances in orbit theory have led to major advances in computational quantum chemistry and physics, all within the overall framework of ECE theory. These developments demonstrate the power of basing physics on the correct geometry of Cartan and co workers. Similarly Dirac made major advances by using the Cartan spinor of 1913, also used by Wolfgang Pauli, a student of Arnold Sommerfeld who first applied special relativity to the atom in 1913.