Essay 25: The Fallacy of Indeterminacy in Quantum Mechanics.

Indeterminacy means that something is absolutely unknowable. This strange idea was introduced in 1927 independently by Bohr and Heisenberg. Not only has it caused great confusion in the subject of natural philosophy (physics), but also in the minds of the general public unversed in the mathematics of quantum operator theory. The operators of quantum mechanics or wave mechanics were introduced by Schroedinger in 1926, guided by the Hamilton Principle of Least Action and the Fermat Principle of Least Time in optics. Schroedinger=s intent was to derive a wave equation for the electron following upon de Broglie=s postulate p = h bar kappa, that all particle momenta are proportional to wavenumber through the reduced Planck constant. The Schroedinger operators for E and momentum p can be used to transform classical equations into wave equations, or first order differential equations. Einstein had proposed earlier that E = h bar omega, meaning that energy is proportional to angular frequency in radians per second through the same reduced Planck constant h bar.

Heisenberg used the p operator of Schroedinger in a commutator, so that [x, p] psi = i h bar psi where psi is a wavefunction. Here x is position. This is a trivial reformulation of the Schroedinger operator, and one which does not give as much information as the Schroedinger equation. In the same year 1927 Bohr arrived at a formula delta x delta p = 1 / 2 simply by making the Fourier transform of a gaussian distribution. There is nothing new or profound in either of these simple exercises. Schroedinger, de Broglie and Einstein saw it in this way form the outset. However Pauli, Bohr and Heisenberg attempted at the Solvay Conference of 1927 to elevate their exercises into a principle of philosophy called indeterminacy. Usually this is known misleadingly as the Heisenberg Uncertainty Principle, which saturates the media like the propaganda it is. My colleague and co author Prof. Jean-Pierre Vigier mentioned to me at Vigier One in Toronto in 1995 that de Broglie was shouted down at that Solvay Conference. He did not mention by whom, but my guess is that it was Pauli and Heisenberg, both notorious for insulting their colleagues or attempting to do so. I do not know why de Broglie did not shout back with the help of Schroedinger and Einstein and others.

So in note 175(3) on the diary or blog of www.aias.us I decided to show once and for all that indeterminacy is a fallacy. This was done by considering the simplest case of quantum mechanics, energy and momentum for a particle / wave moving in the x axis. I worked out the expectation values of x, the square of x, of p and the square of p using the basic formulae of quantum mechanics found in any textbook such as that of my sometime Oxford colleague, Peter Atkins, AMolecular Quantum Mechanics@. The first disaster I came across was the normalization is infinite, not unity. This unpleasant fact of mathematics is brushed under the carpet in quantum mechanics by an artifice, restricting the length of the x axis. If this artifice is not used the result is disaster for Bohr and Heisenberg, as shown clearly in note 175(3). The product of delta x and delta p as defined by them is mathematically indeterminate. Delta p is zero, and delta x is mathematically indeterminate, being infinity divided by infinity. The product is not 1 / 2 as claimed by Bohr. If the artifice of restricting length is used, the product is zero.

To any rational person this means that Bohr and Heisenberg are incorrect. The usual interpretation of the so called Heisenberg Uncertainty Principle is delta x delta p greater than or equal to unity. Even the simplest considerations of note 175(3) show that this is incorrect. Prof. J. R. Croca in his book ATowards a Non Linear Quantum Physics@, published in my World Scientific series in 2003, has given experimental evidence refuting the Heisenberg Uncertainty Principle. In Baconian philosophy experimental data are used to test a

hypothesis. If something is indeterminate it cannot be measured because it is absolutely unknowable. So Heisenberg Bohr is not part of physics at all, and the standard propaganda on this so called principle is just that: propaganda of the worst kind. I doubt whether my predecessor on the Civil List, Sir William Rowan Hamilton, would have given Heisenberg or Bohr a minute of his time. Einstein, Schroedinger and de Broglie rejected them outright while maintaining a polite silence amid the shouting at Solvay in 1927. Schroedinger and Einstein devised paradoxes in quantum mechanics as is well known. In my opinion, these paradoxes are not as clear as note 175(3), which uses the simplest of mathematics. Any competent physicist should surely be able to reject indeterminacy using note 175(3) only. One counter example is enough, but I will probably find others. In ECE theory other explanations have been found for the double slit experiment in which an electron acts as a particle and wave.