Listening to Roger Penrose

Quantum Mechanics was developed to correct deficiencies discovered in the Maxwell-Faraday theory of electromagnetism. Maxwell's equations explain the generation of electromagnetic radiation (radio, infrared, visible, ultraviolet, x-rays, gamma rays) but were unable to explain the color spectrum of light emitted by hot metals and the sun. It was also unable to explain the existence of atoms consisting of a massive nucleus and a 2000 times lighter electron. It said that the electron should continuously lose energy and "fall" into the proton. The quantum theory provided a solution to the energy loss problem, and made quick progress in creating models that predicted the ultraviolet, visible, and infrared emission line spectrum observed. But the physics was hard to accept by many scientists. It seemed to violate common sense when the physics said you can't describe a particle's position and momentum at the same time (Heisenberg uncertainty principle). When multiple-particle systems were modeled, one had to add 2 Pauli constraints: the exclusion principle and the requirement for coordinate exchange symmetry. Also, certain compound particles were able to avoid the Pauli exchange rules. One had to add spin as a new "quasi-degree-of-freedom" to explain the Periodic Table of Elements. Spin also explained the existence of double line emission as seen in sodium vapor lamps.

The apparent violation of common sense and classical logic has led to endless arguments about the nature of Quantum Reality. It became popular to interpret the orbitals of chemistry as probability distributions, which permitted an experimenter to predict where a point-particle would be most likely found in a scattering experiment. This probability function description is called the "Copenhagen interpretation". Enrico Fermi avoided these philosophic discussions and just went ahead and used the wave equation and wave function to calculate expectation values for experiments. Nonetheless, the philosophic argument continues today.

Mathematician Roger Penrose takes the minority view that a wave function is much more than a probability distribution. Penrose is considered one of our greatest living scientists. He is Emeritus Rouse Ball Professor of Mathematics at Oxford University. His 2006 book "The Road to Reality" discusses his quantum reality views. His interpretation makes use of the concept of wave function collapse, which supports the electron density interpretation of an atomic orbital. When an incident x-ray hits an electron orbital it can cause a wave function collapse. The wave function collapse to point size is most likely to occur where the particle density is highest. The correlation between calculated electron density and collapse point is a common sense explanation for the success of the probability interpretation. This book accepts Penrose's wave function collapse picture. Penrose calls the collapse "a state reduction" and designates it by the symbol **R**. Prior to collapse a state can have a weakening density and growing volume, which he calls "unitary behavior" (Schrodinger) evolution, designated **U**. A picture of the time evolution of a state is shown in Fig. 22.1 on page 529 of his book.

The theory used in this discussion of cold fusion seems consistent with the physics known before 1989, when cold fusion was announced. The language of chemistry seems especially appropriate, and adequate to visualize the cold fusion process as thus far understood. Treating 2-body systems as 6-degree-of-freedom objects, plus spin, seems to work. Worries about a need to produce a more precise theory should not be permitted to delay development of quasiparticle-based clean energy for the near future.