RADIATION DAMPING AND NONLINEARITY IN THE PILOT WAVE INTERPRETATION OF QUANTUM MECHANICS

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ABSTRACT:
It is claimed that orthodox quantum mechanics (OQM) is not a scientific theory, but a set of computational recipes. Fundamental differences between the pilot wave interpretation (PWI) and OQM, and their experimental consequences are summarized. PWI is modified for a bound particle by accepting only real eigenfunctions of Schrödinger's time independent equation, in which case the particle is stationary with the electrostatic and quantum force canceling each other. The effect of radiation damping leads to a nonlinear term proportional to \(\partial^2 \ln(\psi/\psi^*)/\partial t^2\) in the first approximation. It is shown that the stationary states are stable with the resonant frequencies given by Bohr's relation, \(\omega_{nm} = (E_n - E_m) / \hbar\).

In order to place in better perspective the possible progress in the pilot wave interpretation (PWI) that we (C.E.Aveledo, D.Bonyuet, L.A.Lameda, and I) have made in Cumana, I should like to make a few general remarks concerning orthodox quantum mechanics (OQM).

To begin with, there can be no doubt that, over the last 80 years or so, OQM has been an extremely useful tool which has permitted the calculation of certain quantities to a part per million or even better, and the development of devices such as transistors and lasers. However, I claim, in essential agreement with Einstein, Schrödinger, and de Broglie, that OQM is only a tool; that is, a series of recipes for the manipulation, interpretation, and reinterpretation of mathematical formulae—a
sort of cook book tecnology.

The discussion (or, more truthfully, the bitter debate) begins when it is claimed that OQM is a scientific theory; i.e., that OQM can be formulated in accordance with the precepts accepted in practice over the last century by any competent scientist, excluding certain historical aberrations such as the rejection of the atomic theory by Mach, Ostwald, and their followers. If we overlook, in the first approximation, certain differences in detail, language and style, we find surprisingly similar descriptions of the implicit or working philosophy of modern science in the writings of Lenin (1908), Planck (1932), Einstein (1918, 1921, 1927, 1933, 1936, 1949), Popper (1935), Bohm (1957), and Bunge (1967, 1972, 1973, 1981). For our purposes, the main features of the working philosophy of modern science are the following:

1) A scientific theory is materialistic, or for those who shy away from this term, realistic; that is, a scientific theory concerns itself only with matter in motion and does not accept explanations based on spirits, divine intervention, or supernatural mental powers which can, for example, reduce wave packets (von Neumann, 1932).

2) A scientific theory is reductionist; that is, it reduces qualitative differences to quantitative differences; it seeks to explain laws at a "higher" level as emerging from laws at a more basic level. Examples of reductionism are thermodynamics in terms of statistical mechanics; chemistry in terms of molecular physics; optics in terms of electrodynamics; biology in terms of biochemistry; etc.

3) A scientific theory is logical; that is, its theorems (or laws) are deducible in accordance with the rules of formal logic from a set of consistent fundamental laws, called postulates or axioms, formulated in terms of primitive (irreducible or nondefinable) concepts. Examples of primitive concepts are mass, charge, position, time, electric field, and magnetic field. Examples of physical postulates are Maxwell's equations in a vacuum. A postulate in a scientific theory does not contain terms such as "measurement" or "observation" which are highly complex concepts belonging to the pinnacle of science, not to its foundations.

4) A scientific theory must be testable; that is, it must be possible to perform experiments or make observations which may agree or disagree with the logical consequences of the theory. But here we must be careful, remembering that no experiment or observation is theory free, and no theory is philosophy free. Our experimental observations acquire meaning only after being processed theoretically; strictly speaking, we have at our disposal only data, never "facts".

5) Finally, despite the occasional and not very convincing objections of Bunge and Popper, a scientific theory must be based on strict determinism; that is if, under supposedly identical