

NOTAS Y COMENTARIOS

A NOTE ON THE DILEMMA OF QUANTUM MECHANICS

WILLIS H. TRUITT

In *Diálogos* 45 (1985), pp. 49-92 Professor Sánchez writes that the hidden variable solution to the problem of incompleteness in quantum mechanics, "...that is, undiscovered variables whose future discovery may put an end to the causal incompleteness of the standard theory of quantum phenomena..." has been ruled out by current empirical evidence. I wish to take issue with this claim below but first let us take a glimpse at some of the work in this field.

One way to avoid both the incipient idealism and outright mysticism that shrouds the Copenhagen Interpretation and the hidden variable theories advanced in defense of scientific realism can be found in the axiomatic formulation of M. Bunge (*Scientific Materialism*, Dordrecht: Reidel, 1981). But it must be recognized that axiomatic formulations are, in the last analysis, mere conveniences in the absence of adequate "causal" theories. Furthermore, axiomatic "treatments", because they are stipulated, lack heuristic content and therefore often act as a brake on other avenues of inquiry. One example of this is Dirac's axiomatic thesis that the position and momentum operators do not commute (another way of stating Heisenberg's Uncertainty Principle). But recently it has been shown how to obtain the Dirac commutator from the London-Weyl formalism by using Weyl's pro-

Diálogos, 49 (1987) pp. 129-131.

jective geometry to deduce the axiom of Dirac (J. Godfrey, *Phys. Review Letters*, 16 April, 1984). On the basis of this procedure it would seem that the geometrical properties of space are determined in part by the particle used to probe that space. It is also interesting that such a situation is implied in A. Shimony's article "Metaphysical Problems in the Foundations of Quantum Mechanics" (*International Philosophical Quarterly*, 18, 1978, p. 15) which is the main object of Professor Sánchez' critical study.

Of course the best known statements of the incompleteness of the conventional interpretation of quantum mechanics are the Einstein, Podolsky, Rosen paradox (*Phys. Review*, 1935) which Sánchez cites, and the several attempts to correct this incompleteness by hypothesizing hidden variables. It was believed that the hidden variable approach had been once, and for all, refuted by von Neumann, but his "proof" now seems to have been found lacking by J. Bell (*Rev. of Modern Physics*, 18, 1966) as Sánchez acknowledges. And recently it has been claimed that the experiments of A. Aspect (*Phys. Rev. D.*, 14, 1976) on photon correlations demonstrate the validity of conventional quantum mechanics so that a statistical understanding of causality is preferable to hidden variable solutions. But this has been challenged by S. Marshall (*Phys. Letters*, 3 Oct., 1982) who demonstrates that one class of local hidden variable theory is in exact agreement with Aspect's experimental results. It is quite probable then that Professor Sánchez' claim, that current empirical evidence rules out a hidden variable solution, is mistaken. And if this is so, his more general recommendation that we dispense with the "natural conception of knowledge" advocated by Einstein, Podolsky and Rosen and defended by Shimony is at least premature and perhaps inappropriate.

The "philosophical" solution favored by Sánchez would show how the results of physical inquiry fit within a general conception of being and thinking which from a scientific standpoint are themselves physical processes. This seems untenable given the current state of our knowledge of physics.

Everyone should be aware of the contradictions and unsatisfactory nature of the standard interpretation of quantum mechanics. Unfortunately this condition continues to lead to either mystification or the Platonism of Heisenberg of which I take Professor Sánchez' views to be a late 20th century variation.

University of South Florida