LBL-15753
Preprint

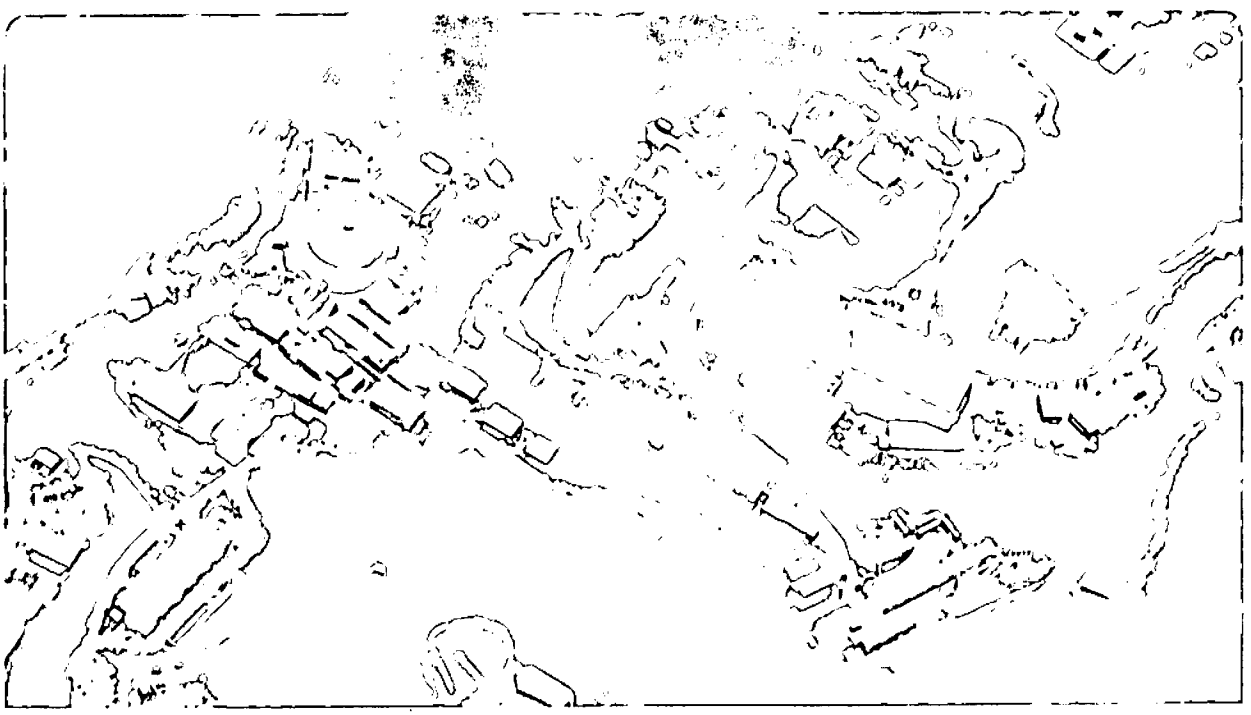
Lawrence Berkeley Laboratory
UNIVERSITY OF CALIFORNIA

Physics, Computer Science & Mathematics Division

Submitted for publication

STAPP RESPONDS TO MOLDAUER

February 1983



Prepared for the U.S. Department of Energy under Contract DE-AC03-76SF00098

DISCLAIMER

LBL-15753

Stapp Responds to Moldauer*

H.P. Stapp

Lawrence Berkeley Laboratory

University of California

Berkeley, California 94720

Published as a Comment in *Physical Review Letters*

February 1983

---

*This work was supported by the Director, Office of Energy Research, Office of High Energy and Nuclear Physics, Division of High Energy Physics of the U.S. Department of Energy under Contract DE-AC03-76SF00098.

Stapp responds: Moldauer's comment[1] rests on his statement that in quantum theory two incompatible observables, 0_1 and 0_2, cannot both be assigned definite values. This statement is imprecise. According to quantum theory 0_1 and 0_2 cannot both be experimentally assigned definite values conjunctively. For when experimental values are considered the observed system must be regarded as an integral part of a whole experimental arrangement, and the arrangements needed to give definite values to 0_1 and 0_2'cannot occur conjunctively. Also, according to quantum theory, 0_1 and 0_2 cannot, in general, both be conceptually assigned definite values conjunctively.[2] For a state that makes 0_1 definite will, in general, make 0_2 indefinite.

On the other hand, quantum theory asserts that: (1) if the arrangement is suitable for measuring 0_1, then 0_1 is experimentally assigned a definite value; and (2) if the arrangement is suitable for measuring 0_2, then 0_2 is experimentally assigned a definite value.

Quantum theory assigns in principle a probability to each conceivable result of each alternative possible measurement on any atomic system. The nonlocality property defined in ref. 3 is a mathematical property of the complete set of quantum probabilities, and is thus a mathematical property of quantum theory. In proving this property one conceptually assigns definite results conjunctively to each of four alternative possible mutually incompatible physical systems of object plus measuring devices. The alternative possible devices can be constructed from different sets of particles, and hence will be represented in different Hilbert subspaces. This situation is not equivalent to either of those described in paragraph one. For the projection operators corresponding to the four alternative possible results now act in different Hilbert spaces, and hence commute. Thus the observables are compatible, and the arguments of Moldauer are inapplicable.

The essential distinction here is between four conditions imposed conjunctively on a single physical system and four conditions imposed conjunctively, one on each of four alternative possible physical systems. In the latter case, unlike the former, no contradiction with the quantum formalism can be derived from the conjunctive assignments alone.

As regards Pitowsky's work, his model is no counterexample to nonlocality theorems, for considered as a local model of the individual physical processes it cannot fit the quantum predictions,[4,5] and considered as a procedure for computing probabilities it is nonlocal.[6,7]

This work was supported by the director, Office of Energy Research, Office of High Energy and Nuclear Physics, Division of High Energy Physics of the U.S. Department of Energy under Contract DE-AC 03-76SF00098.

Henry P. Stapp

Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720

1. P.A. Moldauer, *Phys. Rev. Lett.*
2. P.A.M. Dirac, The Principles of Quantum Theory (Oxford Univ. Press, Oxford, 1947) p.49.
3. H.P. Stapp, *Phys. Rev. Lett. 49, 1470 (1982).*
4. N.D. Merwin, *Phys. Rev. Lett. 49, 1214 (1982).*
5. A.L. MacDonald, *Phys. Rev. Lett. 49, 1215 (1982).*
6. H.P. Stapp, Comment on Proposed Resolution of the Einstein-Podolsky-Rosen and Bell Paradoxes, LBL-14792 (August 1982).
7. H.P. Stapp, Axiomatic Set Theory and Proposed Resolution of the Einstein-Podolsky-Rosen and Bell Paradoxes, LBL-15243 (November 1982).

TECHNICAL INFORMATION DEPARTMENT
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720