Qeios

Peer Review

Review of: "Axiomatic Foundation of Quantum Measurements and Survival Effect"

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The paper is based upon the usual Hilbert space formulation in the discrete case. From this point of departure, the measurement problem is addressed in terms of a few postulates. The basic components are the quantum system (QS), the measurement device (MD), and the environment system (ES).

Postulate 1 is the usual interpretation of eigenvalues and eigenvectors. Postulate 2 concerns the time development of the combined system. Postulate 3 describes MD+ES after measurement. Postulate 4 gives the density matrix of the combined system QS+MD. From these postulates, the measurement process is described. In particular, the density matrix of QS is given.

A nondemolition measurement is discussed based on two different orthogonal basis systems. After this, continuous measurements of position and momentum are reduced to the discrete case by introducing a rigged Hilbert space. Non-ideal measurements with a probability distribution of the measurement's stating time (survival time) are described in terms of a reduced density matrix of QS (Postulate 5). This is specialized to the measurement of position and momentum, giving a modification of the Heisenberg uncertainty relation. This, and some related relations, are discussed in some detail.

The axiomatic formulation of quantum measurements presented in this paper shows that the satisfactory solution to the quantum measurement problem can be based on a rigorous approach using the rigged Hilbert space and an appropriate set of postulates describing the measurement process.

Declarations

Potential competing interests: No potential competing interests to declare.

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