Hess, Karl; Philipp, Walter
A possible loophole in the theorem of Bell. (English) Zbl 1004.81002

Summary: The celebrated inequalities of Bell are based on the assumption that local hidden parameters exist. When combined with conflicting experimental results, these inequalities appear to prove that local hidden parameters cannot exist. This contradiction suggests to many that only instantaneous action at a distance can explain the Einstein, Podolsky, and Rosen type of experiments. We show that, in addition to the assumption that hidden parameters exist, Bell tacitly makes a variety of other assumptions that contribute to his being able to obtain the desired contradiction. For instance, Bell assumes that the hidden parameters do not depend on time and are governed by a single probability measure independent of the analyzer settings. We argue that the exclusion of time has neither a physical nor a mathematical basis but is based on Bell’s translation of the concept of Einstein locality into the language of probability theory. Our additional set of local hidden variables includes time-like correlated parameters and a generalized probability density. We prove that our extended space of local hidden variables does not permit Bell-type proofs to go forward.

MSC:
81P05 General and philosophical questions in quantum theory
81P68 Quantum computation

Keywords:
local hidden parameters; instantaneous action at a distance; Einstein; Podolsky; Rosen; assumptions; Einstein locality; time-like correlated parameters; generalized probability density

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References:

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