

Mauro Dorato

THE PROBLEM OF REALISM BETWEEN QUANTUM MECHANICS
AND SPECIAL RELATIVITY

Abstract

The conceptual tension between quantum mechanics and special relativity is examined from the point of view of the ontological determinateness of events in Minkowski spacetime. Various possible views of the relationship between time and reality are briefly presented, and it is argued that as a result of well-known experimental tests on the violation of Bell inequality, the metaphysical view attributing the same ontological status to past and future becomes incompatible with modern physics.

In order to defend the thesis that the Bell experiments confront us with the need of a new ‘experimental metaphysics’, I begin by criticizing attempts to leave philosophical discussions out of the picture. In particular, by adopting Jarrett’s derivation of Bell inequality, I claim that the so-called Duhem-Quine holistic argument against the *experimentum crucis* in this particular instance is off-mark. Furthermore, I suggest that the violation of the principle of common cause (in the form discussed by Butterfield in his space-time approach to Bell’s theorem) implies that there are at least some future events in Minkowski spacetime that are indeterminate as of arbitrary events chosen as “here-now”. The result of the discussion is that those interpretations of quantum mechanics requiring that the value of magnitudes of a physical system are objectively indeterminate before measurement are perfectly compatible with special relativity, despite arguments to the contrary. In the last part of the paper, it is argued that, as a consequence of Stein’s and Clifton-Hogarth’s theorems on the definability of objective becoming in Minkowski spacetime, the nonseparability of spacelike-related events becomes less mysterious, given that relativistically any such two events must be regarded as indeterminate as of each other.