

Forms of Quantum Nonseparability and Related Philosophical Consequences

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Abstract

Abstract: Standard quantum mechanics unquestionably violates the separability principle that classical physics (be it point-like analytic, statistical, or field-theoretic) accustomed us to consider as valid. In this paper, quantum nonseparability is viewed as a consequence of the Hilbert-space quantum mechanical formalism, avoiding thus any direct recourse to the ramifications of Kochen-Specker's argument or Bell's inequality. Depending on the mode of assignment of states to physical systems—unit state vectors versus non-idempotent density operators—we distinguish between strong/relational and weak/deconstructional forms of quantum nonseparability. The origin of the latter is traced down and discussed at length, whereas its relation to the all important concept of potentiality in forming a coherent picture of the puzzling entangled interconnections among spatially separated systems is also considered. Finally, certain philosophical consequences of quantum nonseparability concerning the nature of quantum objects, the question of realism in quantum mechanics, and possible limitations in revealing the actual character of physical reality in its entirety are explored.

Keywords: entanglement, nonseparability, potentiality, quantum holism, scientific realism

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