Quantum Physics

Quantum complementarity and logical indeterminacy

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Whenever a mathematical proposition to be proved requires more information than it is contained in an axiomatic system, it can neither be proved nor disproved, i.e. it is undecidable, or logically undetermined, within this axiomatic system. I will show that certain mathematical propositions on a d-valent function of a binary argument can be encoded in d-dimensional quantum states of mutually unbiased basis (MUB) sets, and truth values of the propositions can be tested in MUB measurements. I will then show that a proposition is undecidable within the system of axioms encoded in the state, if and only if the measurement associated with the proposition gives completely random outcomes.

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