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Constructing qubits in physical systems. (English summary)

Quantum information and computation.


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The rapidly growing field of quantum information, which covers quantum information theory, quantum communication, quantum computation, quantum complexity, and quantum game theory, is built around the notion of the quantum bit or qubit. A qubit is the elementary unit of quantum information, and is defined as the quantum information carried by a two-state quantum system. The concept of qubit is the natural extension of that of the classical bit, when the quantum description of the states of the physical systems and the superposition principle are taken into account. As in the case of the classical bit, the notion of qubit is independent of the details of the specific physical system considered. In spite of its simple definition, identifying qubits in physical systems is often unexpectedly difficult. Thus to determine the suitability of a physical system for quantum information processing, it is important to identify the essential criteria that characterize a qubit. Several examples of proposed physical qubits are examined and then some criteria to identify qubits in terms of quantum observables rather than states are proposed.

Reviewed by Adán Cabello