

## General Quantum Interference Principle and Duality Computer

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**Abstract:** In this article, we propose a general principle of quantum interference for quantum system, and based on this we propose a new type of computing machine, the duality computer, that may outperform in principle both classical computer and the quantum computer. According to the general principle of quantum interference, the very essence of quantum interference is the interference of the sub-waves of the quantum system itself. A quantum system considered here can be any quantum system: a single microscopic particle, a composite quantum system such as an atom or a molecule, or a loose collection of a few quantum objects such as two independent photons. In the duality computer, the wave of the duality computer is split into several sub-waves and they pass through different routes, where different computing gate operations are performed. These sub-waves are then re-combined to interfere to give the computational results. The quantum computer, however, has only used the particle nature of quantum object. In a duality computer, it may be possible to find a marked item from an unsorted database using only a single query, and all NP-complete problems may have polynomial algorithms. Two proof-of-the-principle designs of the duality computer are presented: the giant molecule scheme and the nonlinear quantum optics scheme. We also propose thought experiment to check the related fundamental issues, the measurement efficiency of a partial wave function.

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Key words: quantum interference, duality computer, NP-complete=P

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