

Quantum computing implementations with neutral particles

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Reference:

Quantum Inf. Process. 10, 721 (2011).

From the issue entitled "Special Issue on Neutral Particles".

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We review quantum information processing with cold neutral particles, that is, atoms or polar molecules. First, we analyze the best suited degrees of freedom of these particles for storing quantum information, and then we discuss both single- and two-qubit gate implementations. We focus our discussion mainly on collisional quantum gates, which are best suited for atom-chip-like devices, as well as on gate proposals conceived for optical lattices. Additionally, we analyze schemes both for cold atoms confined in optical cavities and hybrid approaches to entanglement generation, and we show how optimal control theory might be a powerful tool to enhance the speed up of the gate operations as well as to achieve high fidelities required for fault tolerant quantum computation.

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