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RF-induced Förster resonances for Rydberg QC

Precise control of many-body Rydberg interactions in atomic registers is extremely relevant for quantum computing applications. In this regard, the use of RF and microwave radiation for the induction of interatomic transitions is of great interest nowadays. In this research, we investigated and numerically modeled RF-induced three-body Förster resonances of a fine-structure-changing type $|nP_{3/2}\rangle^{\otimes 3} \rightarrow |nS_{1/2}; (n+1)\,S_{1/2}; nP_{1/2}\rangle$. We also proposed a scheme for the application of such resonances to implement a multi-qubit quantum Toffoli gate. This scheme is a significant development of our previous proposal [1]. We show that the use of RF-induced resonances makes it possible to significantly simplify the quantum gate implementation process, and also gives new nodes for precise control of the atomic system, allowing to increase the quantum gate fidelity.

[1] I. N. Ashkarin et al., Phys. Rev. A 106, 032601 (2022)

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