

Abstract Submitted
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Fast Quantum Gates Using Chirped Pulses VLADIMIR MALINOVSKY, MagiQ Technologies Inc. — A common method to implement quantum gates is based on the Rabi solution regime of a two-level system excited by external field. To construct a quantum gate one uses the exact form of evolution operator of the qubit under the external excitation. In the case of Rabi solution the qubit evolution has very simple and easily interpreted form. In essence, the whole dynamics of the qubit wave function is governed by the pulse area and it exhibits Rabi oscillations for the time less than the decoherence time. Various implementations of the quantum gates employ relatively weak pulses that results in slow gate operations of order microseconds. To make quantum gates faster one may use strong femtosecond pulses. However, direct implementation schemes are not so obvious because of strong field effects and large bandwidth of the pulses might give rise to unwanted excitations. Here we propose a scheme which provides a possibility to utilize strong pulses while keeps all advantages of Rabi solution regime. We design fast quantum gates (picosecond time scale) by choosing proper parameters of the chirped pulses as a way to control nonadiabatic terms and to satisfy the adiabaticity conditions. Proposed Hadamard and phase-shift gate allow us to construct universal set of single qubit gates by controlling the effective pulse area and two-photon detuning. The proposed excitation scheme can be also used to implement CNOT gate.

Vladimir Malinovsky
MagiQ Technologies Inc.

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