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Experimental fault tolerant universal quantum gates with solid-state spins under ambient conditions.[1] XING RONG, University of Science and Technology of China — Quantum computation provides great speedup over classical counterpart for certain problems, such as quantum simulations, prime factoring and database searching. One of the challenges for realizing quantum computation is to execute precise control of the quantum system in the presence of noise. Recently, high fidelity control of spin-qubits has been achieved in several quantum systems. However, control of the spin-qubits with the accuracy required by the fault tolerant quantum computation under ambient conditions remains exclusive. Here we demonstrate a universal set of logic gates in nitrogen-vacancy centers with an average single-qubit gate fidelity of 0.99995 and two qubit gate fidelity of 0.992. These high control fidelities have been achieved in the C naturally abundant diamonds at room temperature via composite pulses and optimal control method. This experimental implementation of quantum gates with fault tolerant control fidelity sets an important step towards the fault-tolerant quantum computation under ambient conditions.

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