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Memory-built-in quantum cloning in a hybrid solid-state spin register WEIBIN WANG, CHONG ZU, LI HE, WENGANG ZHANG, Center for Quantum Information, IIIS, Tsinghua University, Beijing 100084, PR China, LUMING DUAN, Department of Physics, University of Michigan, Ann Arbor, Michigan 48109, USA — As a way to circumvent the quantum no-cloning theorem, approximate quantum cloning protocols have received wide attention with remarkable applications. Copying of quantum states to memory qubits provides an important strategy for eavesdropping in quantum cryptography. We report an experiment that realizes cloning of quantum states from an electron spin to a nuclear spin in a hybrid solid-state spin register with near-optimal fidelity. The nuclear spin provides an ideal memory qubit at room temperature, which stores the cloned quantum states for a millisecond under ambient conditions, exceeding the lifetime of the original quantum state carried by the electron spin by orders of magnitude, and making it an ideal memory qubit. Our experiment is based on control of an individual nitrogen vacancy (NV) center in the diamond, which is a diamond defect that attracts strong interest in recent years with great potential for implementation of quantum information protocols.

Weibin Wang
Center for Quantum Information, IIIS,
Tsinghua University, Beijing 100084, PR China

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