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Multi-second quantum memory based upon a single nuclear spin in a room temperature solid PETER MAURER, GEORG KUCSKO, CHRISTIAN LATTA, Harvard University, LIANG JIANG, Californial Institute of Technology, NORMAN YAO, STEVEN BENNETT, Harvard University, FERNANDO PASTAWSKI, DAVID HUNGER, MPQ, NICK CHISHOLM, Harvard University, MARK MARKHAM, DANIEL TWITCHEN, Element 6, IGNACIO CIRAC, MPQ, MIKHAIL LUKIN, Harvard University — Room temperature solid-state quantum bit with second-long memory Realization of stable quantum bits (qubits) that can be prepared and measured with high fidelity and that are capable of storing quantum information for long times exceeding seconds is an outstanding challenge in quantum science and engineering. Here we report on the realization of such a stable quantum bit using an individual 13C nuclear spin within an isotopically purified diamond crystal at room temperature. Using an electronic spin associated with a nearby Nitrogen Vacancy color center, we demonstrate high fidelity initialization and readout of a single 13C qubit. Quantum memory lifetime exceeding one second is obtained by using controlled dissipative optical decoupling from the electronic degree of freedom. Techniques to further extend the quantum memory lifetime as well as the potential applications are also discussed.

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