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Room temperature solid-state quantum bit with second-long memory GEORG KUCSKO, PETER MAURER, CHRISTIAN LATTA, Harvard University, DAVID HUNGER, LMU Munich, LIANG JIANG, Caltech, FERNANDO PASTAWSKI, Max-Planck-Institut für Quantenoptik, NORMAN YAO, STEVEN BENNET, Harvard University, DANIEL TWITCHEN, Element Six, IGNACIO CIRAC, Max-Planck-Institut für Quantenoptik, MIKHAIL LUKIN, Harvard University, LUKIN GROUP TEAM, CIRAC GROUP COLLABORATION —
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 ^{13}C 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 ^{13}C qubit. Quantum memory lifetime exceeding one second is obtained by using dissipative optical decoupling from the electronic degree of freedom and applying a sequence of radio-frequency pulses to suppress effects from the dipole-dipole interactions of the ^{13}C spin-bath. Techniques to further extend the quantum memory lifetime as well as the potential applications are also discussed.

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