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Room-temperature solid-state quantum memory using pairs of nuclear spins in diamond NIR BAR-GILL, STEPHEN DEVIENCE, DAVID LE SAGE, CHINMAY BELTHANGADY, LINH PHAM, RONALD WALSWORTH, Harvard University — We propose a robust, room-temperature solid-state quantum memory scheme using a pair of nuclear spin impurities in diamond. The memory qubit is encoded in a decoherence-free subspace of this nuclear spin pair, which protects it from noise originating from the surrounding environment. In addition, nuclear spins close to a Nitrogen-Vacancy (NV) color center experience a significant electron-mediated coupling, which further suppresses decoherence of the qubit. We obtain coherence times on the order of a second, along with fast manipulation and readout through the coupling of the nuclear spins to the NV electronic spin. We show that through engineering of the diamond sample this scheme could offer scalability to a many-qubit memory, and could be used as a basic building block for hybrid quantum networks and quantum computing architectures.

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