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Optical quantum memory made from single nuclear spin in nitrogen vacancy in diamond SEN YANG, YA WANG, THAI HIEN TRAN, S. ALI MOMENZADEH, RAINER STOEHR, PHILIPP NEUMANN, 3rd Physics Institute, Universitat Stuttgart, HIDEO KOSAKA, Department of Physics, Yokohama National University, JOERG WRACHTRUP, 3rd Physics Institute, Universitat Stuttgart — Quantum repeater is one of the key elements to realize long distance quantum communication. In the heart of a quantum repeater is quantum memory. There are a few requirements for this memory: it needs to couple to flying qubits: photon; it needs to have long coherence time, so quantum error correction algorithm can be performed in the quantum repeater nods; it needs to be stable under optical illuminations. Nitrogen nuclear spin is available for every nitrogen vacancy center(NV) in diamond. Besides it can be a robust quantum memory for spin qubit operations, nitrogen nuclear spin can couple to photon by taking advantage of optically resonant excitation of spin-selective transitions in low temperature. Here we demonstrate the coherent storage of quantum information from photon into nuclear spin. We show this quantum memory fulfils requirements as quantum memory for quantum repeater. Coherent time beyond 5 seconds is measured in ^{13}C natural abundant sample. Under resonant laser excitations, the excited state quadruple and hyperfine interaction could lead to decoherence of nuclear spin. We show those interactions are low and nuclear spin can keep its coherence over 1000 times resonant laser excitation of electron spin.

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