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Quantum Entanglement Between Optical Photon and Solid-state Spin Qubit EMRE TOGAN, YIWEN CHU, ALEXEI TRIFONOV, Harvard University, LIANG JIANG, California Institute of Technology, JERONIMO MAZE, Harvard University, LILIAN CHILDRESS, Bates College, M.V. GURUDEV DUTT, University of Pittsburgh, ANDERS SORENSEN, University of Copenhagen, PHILIP HEMMER, Texas A&M University, ALEXANDER ZIBROV, MIKHAIL LUKIN, Harvard University — Nonlocal quantum entanglement is among the most fascinating aspects of quantum theory. Motivated by the potential realization of quantum networks that require entanglement of remote quantum nodes with long-term quantum memory, we demonstrate nonlocal entanglement between a single optical photon and a solid-state qubit associated with the single electronic spin of a Nitrogen Vacancy impurity in diamond. Our experiments demonstrate a high degree of control over solid-state qubits in the optical domain and provide a fundamental building block for the realization of quantum optical networks based on long-lived electronic and nuclear spin memory in the solid-state.

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