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Entanglement of Light-Shift Compensated Atomic Spin Waves with Telecom Light YAROSLAV DUDIN, ALEXANDER RADNAEV, RAN ZHAO, JACOB BLUMOFF, BRIAN KENNEDY, ALEX KUZMICH, Georgia Institute of Technology — Long-lived quantum memories interfaced with photonic qubits at telecom wavelengths are the key elements for quantum repeater based long distance quantum telecommunication. We report the observation of Bell's inequality violation (S = 2.66+/-0.09) for a photonic polarization qubit at 1.37 μm wavelength and a rubidium spin-wave qubit stored in a Stark decoherence free optical lattice for 10 ms. We also observed a violation of Bell's inequality (S = 2.65+/-0.12) for a spin-wave qubit entangled with 795 nm light polarization qubit, for 0.1 s storage time. A light qubit at 1.37 μm is generated from 795 nm polarization qubit via an efficient frequency conversion process in an auxiliary cold rubidium sample.

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