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A nanoscale quantum interface for single atoms TOBIAS TIECKE, Harvard University, Department of Physics and Research Laboratory of Electronics, MIT, JEFF THOMPSON, Harvard University, Department of Physics, JOHANNES FEIST, ITAMP, Harvard-Smithsonian center for Astrophysics, CHUN YU, Harvard University, Department of Chemistry, ALEXEY AKIMOV, Harvard University, Department of Physics, DARRICK CHANG, Caltech, ALEXANDER ZIBROV, Harvard University, Department of Physics, VLADAN VULETIC, Center for Ultracold Atoms, Department of Physics, MIT, HONGKUN PARK, Harvard University, Department of Chemistry, MIKHAIL LUKIN, Harvard University, Department of Physics — Neutral atoms are ideal quantum systems: they have long ground-state coherence times and strong optical cycling transitions that enable state detection and preparation. Building quantum networks of atoms interacting through photons is challenging, however, as many schemes for atom-photon interaction are inefficient or hard to scale. We propose a scheme to trap neutral atoms near silver nanowires, which are tightly confining waveguides for surface plasmons. The nanowire tip is used to generate a near-field optical trapping potential, and to enhance and efficiently collect spontaneous emission from the atom. We present experimental results on using the atom to sense the optical field at submicron distances from the wire and our current efforts towards loading the nanotrap.

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