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A Nanoscale Quantum Interface for Single Atoms JEFF THOMPSON, Harvard University, ALEXEY AKIMOV, Harvard University; P.N. Lebedev Physical Institute, FRANK KOPPENS, Harvard University, DARRICK CHANG, Caltech, ALEXANDER ZIBROV, MIKHAIL LUKIN, Harvard University — We propose and analyze a scheme to interface individual neutral atoms with nanoscale solid-state systems. The interface is enabled by optically trapping the atom via the strong near-field generated by a sharp metallic nanotip. We show that under realistic conditions, a neutral atom can be trapped with position uncertainties of just a few nanometers, and within tens of nanometers of other surfaces. Simultaneously, the guided surface plasmon modes of the nanotip allow the atom to be optically manipulated, or for fluorescence photons to be collected, with very high efficiency. Finally, we analyze the surface forces, heating and decoherence rates acting on the trapped atom. In this presentation, we discuss the general properties of these systems, schemes for loading and cooling atoms in very small traps, and current experimental progress toward loading nanowire traps from a Rb MOT.

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