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3D Raman sideband cooling of single atoms in an optical tweezer trap JEFF THOMPSON, TOBIAS TIECKE, Department of Physics, Harvard University, VLADAN VULETIC, Department of Physics, MIT-Harvard Center for Ultracold Atoms and Research Laboratory of Electronics, Massachusetts Institute of Technology, MIKHAIL LUKIN, Department of Physics, Harvard University —
We have cooled a single atom in an optical tweezer trap very close to its three-dimensional ground state. An atom loaded with an initial temperature of around 110 uK has radial and axial occupation numbers of $n_r = 23$ and $n_a = 170$; after cooling, we achieve final occupation numbers of $n_r < 0.1$ and $n_a = 7.5$. The principal technical challenge we encountered was effective magnetic field gradients arising from distortions of the dipole trap polarization in the optical tweezer focus, which we will discuss in some detail. Additionally, we will present ongoing work on two fronts: using the tightly localized atom to sense optical fields on the nanometer-scale, and bringing the atom close to nanoscale optical waveguides and can ities with the goal of achieving strong atom-photon interactions.

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