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Vibrational ground state cooling of a neutral atom in a tightly focused optical dipole trap SYED ALJUNID, GLEB MASLENNIKOV, MARTIN PAESOLD, KADIR DURAK, VICTOR LEONG, CHRISTIAN KURTSIEFER, Centre for Quantum Technologies / Nat. Univ. Singapore — Recent experiments have shown that an efficient interaction between a single trapped atom and light can be established by concentrating light field at the location of the atom by focusing [1-3]. However, to fully exploit the benefits of strong focusing one has to localize the atom at the maximum of the field strength [4]. The position uncertainty due to residual kinetic energy of the atom in the dipole trap (depth $\sim$ 1mK) after molasses cooling is significant (few 100 nm). It limits the interaction between a focused light mode and an atom already for moderate focusing strength [2]. To address this problem we implement a Raman Sideband cooling technique, similar to the one commonly used in ion traps [5], to cool a single ^{87}Rb atom to the ground state of the trap. We have cooled the atom along the transverse trap axis (trap frequency $\nu_\tau = 55\,\mathrm{kHz}$), to a mean vibrational state $\bar{n_\tau} = 0.55$ and investigate the impact on atom-light interfaces.

[1] M. K. Tey, et al., Nature Physics **4** 924 (2008)
[2] M. K. Tey et. al., New J. Phys. **11**, 043011 (2009)
[3] S.A. Aljunid et al., PRL **103**, 153601 (2009)
[4] C. Teo and V. Scarani Opt. Comm. **284** 4485-4490 (2011)
[5] C. Monroe et al., PRL **75**, 4011 (1995)

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