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Substantial interaction between a singe atom and a focused light beam GLEB MASLENNIKOV, SYED ABDULLAH ALJUNID, JIANWEI LEE, BRENDA CHNG, HOANG LAN DAO, Centre for Quantum Technologies, National University of Singapore, MARTIN PAESOLD, ETH Zurich, VALERIO SCARANI, CHRISTIAN KURTSIEFER, Centre for Quantum Technologies/Phys.Dept, National University of Singapore — We investigate both theoretically and experimentally the near-resonant interaction between a single atom in an optical dipole trap and a focused coherent light beam. We have demonstrated that even for a moderate focusing strength, a single atom localized at the focus of a simple aspheric lens can scatter a significant fraction of light[1,2], impose a phase shift [3], and partially reflect a probe beam. With our current experimental system, we observe an extinction of 10%, a phase shift of about 1° and a reflectivity of 0.17%. For an optimal focusing geometry, we would expect an extinction up to 92%, a phase shift of 30°. The strength of the observed effect suggests that an efficient interface between atoms and photons for quantum information purposes can be established – either without cavities, or by enhancing the electrical field in in a low-finesse cavity simply by strong focusing. We report on our experimental progress towards this goal.
[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., Phys. Rev. Lett. **103**, 153601 (2009)

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