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Integrated Optical Dipole Trap for Cold Neutral Atoms with an Optical Waveguide Coupler[1] J. LEE, JQI/UMD, D.H. PARK, S. MITTAL, Y. MENG, M. DAGENAIS, ECE/UMD, S.L. ROLSTON, JQI/UMD — Using an optical waveguide, an integrated optical dipole trap uses two-color (red and blue-detuned) traveling evanescent wave fields for trapping cold neutral atoms. To achieve longitudinal confinement, we propose using an integrated optical waveguide coupler, which provides a potential gradient along the beam propagation direction sufficient to confine atoms. This integrated optical dipole trap can support an atomic ensemble with a large optical depth due to its small mode area. Its quasi-TE_0 waveguide mode has an advantage over the HE_{11} mode of a nanofiber, with little inhomogeneous Zeeman broadening at the trapping region. The longitudinal confinement eliminates the need for a 1D optical lattice, reducing collisional blockaded atomic loading, potentially producing larger ensembles. The waveguide trap allows for scalability and integrability with nano-fabrication technology. We analyze the potential performance of such integrated atom traps and present current research progress towards a fiber-coupled silicon nitride optical waveguide integrable with atom chips.
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