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A Mode Cleaner Cavity for Improved Stability of an Optical Dipole Trap[1] PATRICK BAGGE, DE LUO, JASON H. V. NGUYEN, RANDALL G. HULET, Department of Physics and Astronomy and Rice Center for Quantum Materials, Rice University, Houston, TX 77005 — The use of optical dipole traps has become a standard technique to trap ultracold atoms. Generated by a focused, far-detuned laser beam, our single-beam optical dipole trap is intended to be a strictly TEM_{00} mode, as the presence of higher order modes can introduce instabilities in the trap. In particular, the location of the laser beam focus can vary over time when higher-order modes are present. We implement a monolithic mode cleaner cavity designed to pass the TEM_{00} mode and suppress higher-order transverse modes. The cavity consists of four mirrors in a bow-tie configuration and is locked on resonance by using the tilt locking method[2]. We characterize the performance of the cavity and its effect in improving the stability of an optical dipole trap used in experiments with bright matter-wave solitons.

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[2]D. Shaddock, M. Gray, and D. McClelland, Opt. Lett. 24, 1499-1501 (1999).

Patrick Bagge
Rice University

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