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Experimental Realization of an Optical One-Way Barrier for Neutral Atoms TAO LI, JEREMY THORN, ELIZABETH SCHOENE, DANIEL STECK, Oregon Center for Optics and Department of Physics, University of Oregon — We demonstrate an asymmetric optical potential barrier for ultracold ^{87}Rb atoms using laser light tuned near the D_2 optical transition, which could be a promising general method of laser cooling and trapping applicable to atoms and molecules not amenable to standard laser-cooling techniques. In addition, the one-way barrier, where atoms impinging on one side are transmitted but reflected from the other, is a literal realization of Maxwell's demon. In our experiment, atoms are confined to a far-detuned dipole trap consisting of a single focused Gaussian beam, which is divided near the focus by the barrier. The one-way barrier consists of two focused laser beams oriented almost normal to the dipole-trap axis. The first beam is tuned to have a red (blue) detuning from the $F = 1 \rightarrow F'$ ($F = 2 \rightarrow F'$) hyperfine transitions, and thus presents a barrier only for atoms in the $F = 2$ ground state, while letting $F = 1$ atoms pass. The second beam pumps the atoms to $F = 2$ on the reflecting side of the barrier, thus producing the asymmetry. We study experimentally the reflection and transmission dynamics of ultracold atoms in the presence of the one-way barrier.

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