

Abstract Submitted
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Low photon scattering rates and large optical depths of atoms in donut modes of hollow core optical fibers JOSEPH A. PECHKIS, FREDRIK K. FATEMI, Naval Research Laboratory, 4555 Overlook Avenue S.W., Washington, DC 20375 — We have guided cold rubidium atoms in blue-detuned hollow optical modes of a hollow fiber. These higher order modes allow large optical depth, low scattering rates, and efficient use of guide laser power. Atoms are transported through a 3-cm-long hollow fiber with a 100 micron diameter using the first three optical modes of the fiber. We compare guiding properties in the red-detuned, fundamental HE_{11} mode with the blue-detuned TE_{01} (first order) and HE_{12} (second order) modes. Using guide laser powers below 50 mW and detunings below 1.5 nm, we have directly measured recoil scattering rates in the three different guides and found that atoms in the HE_{12} mode typically have a 10x lower recoil scattering rate compared to the red-detuned HE_{11} mode for equal guide peak intensity. Furthermore, we have observed optical depths of ~ 20 for the blue-detuned guides with recoil scattering rates below 10 Hz. We will discuss our ongoing experiments using the atoms in these guides. This work supported by the Office of Naval Research and the Defense Advanced Research Projects Agency.

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