

# Funneling of cold atoms by a small hollow laser beam

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There has been much progress in guiding cold atoms through the small structures such as hollow core optical fiber or current carrying wires. In particular, hollow-core optical fiber (HOF) has a great merit in that we can focus the cold atoms to the sub-micron size spot and control guiding path very easily. However, small entrance area limits the coupling efficiency of atoms to the fiber, which reduces the usefulness of the hollow fiber guides. We have developed an atom funnel using the hollow beam generated directly by the hollow fiber which is used for atom guiding as well. The continuous cold atomic beam is extracted from the magneto-optical trap in the pyramidal hollow mirror system. The divergence of the hollow beam is approximately 30 mrad and length of the funneling region is about 3 cm between the trap and the HOF. We measure the beam characteristics by the absorption of a probe laser beam. We will report on the experimental and theoretical results of the funneling and guiding of cold atoms.