Abstract Submitted
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Atomic manipulation for a hybrid system: tapered optical fibers with high transmission and a pyramid MOT[1] J.E. HOFFMAN, J.A. GROVER, JQI/UMD, M. HAFEZI, JQI/NIST, J.B. HERTZBERG, P. KORDELL, J. LEE, JQI/UMD, S. RAVETS, Institute d'Optique, Palaiseau, U. CHUKWU, K.D. VOIGT, J.R. ANDERSON, G. BEADIE, F.K. FATEMI, C.J. LOBB, L.A. OROZCO, JQI/UMD, J.M. TAYLOR, JQI/NIST, S.L. ROLSTON, F.C. WELLSTOOD, JQI/UMD — To create a hybrid quantum system, we plan to trap neutral atoms in the evanescent optical field from an optical nanofiber and move them to within a few microns above a SQUID in a dilution refrigerator that operates at 10 mK. A key component in this experiment is a long section (10 cm) of optical fiber with a uniform diameter of about 500 nm, sufficiently small that the light propagates on the surface of the fiber as an evanescent wave. We have produced suitably long nanofibers with carefully tapered sections that allow matching of the optical field in the tapered and untapered sections. We have achieved more than 99.95% transmission of the fundamental mode and good evanescent fields; as well as more than 85% transmission when using higher order modes. A single-beam, magneto-optical trap that uses optical gratings captures and cools atoms to load on the nanofiber to work at cryogenic temperatures. We will present our technique, key results, and progress towards trapping atoms on the fibers.

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