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Quantum state control of trapped Holmium atoms[1] JAMES HOSTETTER, CHRISTOPHER YIP, WILLIAM MILNER, DONALD BOOTH, JEFFREY COLLETT[2], MARK SAFFMAN, Department of Physics, University of Wisconsin-Madison — Neutral Holmium with its large number of hyperfine ground states provides a promising approach for collective encoding of a multi-qubit register. A prerequisite for collective encoding is the ability to prepare different states in the 128 state hyperfine ground manifold. We report progress towards optical pumping and control of the hyperfine Zeeman state of trapped Ho atoms. Atoms are transferred from a 410.5 nm MOT into a 455 nm optical dipole trap. The atoms can be optically pumped using light driving the ground $6s^2, F = 11$ to $6s6p, F' = 11$ transition together with a $F = 10$ to $F' = 11$ repumper. Microwave fields are then used to drive transitions to hyperfine levels with $4 \leq F \leq 11$.

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