Design of a many qubit quantum computer by ensemble encoding in Ho atoms[1] MARK SAFFMAN, Department of Physics, University of Wisconsin, KLAUS MOLMER, Lundbeck Foundation Theoretical Center for Quantum Systems Research, University of Aarhus, Denmark — We present a design for a many qubit, fully interconnected quantum computer using collective encoding in the hyperfine ground states of Ho. Using established optical techniques we describe a complete approach to preparation and manipulation of 60 qubit quantum registers encoded in symmetric multi-atom superpositions of Ho ground states. Single qubit operations rely on stimulated Raman transitions, two-qubit gates use Rydberg blockade, and measurements of individual register bits are performed by shelving to metastable states. Combining several 60 qubit registers in a small 2D array of optical traps leads to a fully connected design for a 1000 qubit scale quantum processor.

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