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Suppression of collisional decoherence by dynamical decoupling in optically trapped dense atomic ensemble YOAV SAGI, IDO ALMOG, NIR DAVIDSON, Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot, Israel — An ensemble of two level quantum systems coupled to a fluctuating external environment is a common paradigm in many fields of study. This coupling leads to decoherence that limits the usefulness of these systems, e.g. as qubits in quantum computation systems. Application of external pulses can reduce the decoherence by utilizing symmetry properties of the coupling Hamiltonian to average out its effect, a method commonly referred to as dynamical decoupling. In the case of trapped atoms these techniques can be especially useful since the fluctuations are inherent to the desirable high densities required to achieve a good overall efficiency of quantum operations. Here we report on experiments with optically trapped ^{87}Rb atoms demonstrating a 20-fold increase of the coherence time when a dynamical decoupling sequence with more than 200 π-pulses is applied. By starting with different initial states and using state tomography we demonstrate that a dense ensemble with $OD \approx 100$ can store an arbitrary superposition for more than 3 seconds.

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