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Probing Coherence in a Cold Rydberg Gas M.R. KUTTERUF, R.R. JONES, University of Virginia — We have used pulsed electric-field sequences to probe the coherence of dipole-dipole interactions in a MOT. Nanosecond dye lasers excite Rb atoms to the $|25s_{1/2} >$ and $|33s_{1/2} >$ states in an electric field. The field tunes the atoms so that the energy difference between $|25s_{1/2} > |33s_{1/2} >$ and $|24p_{1/2} > |34p_{3/2} >$ atom pairs is Δ. For typical separations, the dipole-dipole coupling between atoms enables coherent population transfer from $|25s_{1/2} > |33s_{1/2} >$ to $|24p_{1/2} > |34p_{3/2} >$ at a rate comparable to Δ.After a time T, an electric field step diabatically tunes the pair energy splitting to -Δ. The atoms interact for an additional time T and the population in the $|24p_{1/2} > |34p_{3/2} >$ state is measured. The pulse sequence enhances the $|24p_{1/2} > |34p_{3/2} >$ population relative to that obtained in a time 2T at fixed detuning, +/-Δ. Sequences involving multiple resonance traversals lead to further enhancement, indicating that this effect is due to the coherence of the dipole-dipole interaction rather than excitation of different sets of atoms in the ensemble. The enhancement decays as T approaches several microseconds. On this time scale, atomic motion may play a substantive role. This work is supported by NSF and AFOSR.

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