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Coherent Transfer of Electronic Wavepacket Motion Between Atoms[1] TAO ZHOU, B.G. RICHARDS, R.R. JONES, University of Virginia —

We have shown that electron correlations, induced by controlled dipole-dipole (DD) interactions, can enable the coherent transfer of electronic wavepacket motion from atoms to their neighbors. In the experiment, a 5 ns tunable dye laser excites Rb atoms in a MOT to the 25s state in a weak static electric field for which the tunable 25s33s↔24p34p DD interaction is resonant. A picosecond THz pulse then further excites each Rydberg atom into a coherent superposition, of 25s and 24p states. The evolution of this mixed-parity wavepacket is characterized by time-dependent oscillations in the electric dipole moment, with a period of 2.9 ps. Approximately 5 ns after the wavepacket creation, a second 5 ns dye-laser promotes a second set of atoms from the 5p level into the 33s state. Because of the DD interaction, the second dye laser actually creates atom pairs whose electronic states are correlated via the resonant DD coupling. A 33s+34p wavepacket, oscillating with the same 2.9 ps period as the 25s+24p wavepacket, develops on the second set of atoms as a result of the correlation. A second, time-delayed ps THz pulse enables the detection of the coherent wavepacket motion on the two sets of atoms.

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