DAMOP06-2006-000420

Abstract for an Invited Paper
for the DAMOP06 Meeting of
the American Physical Society

Microwave manipulation of an atomic electron.

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Applying a microwave field to an atom at its Kepler orbital frequency, the frequency of the Δ n = 1 transition, phase locks the motion of the electron, producing a non dispersing wave packet. Such wavepackets are robust and do not disperse for thousands of orbits. The phase locked electron's motion can be sped up or slowed down by chirping the frequency of the microwave field, and changes in n of 10 have been observed. In quantum mechanical terms such a process is adiabatic passage through a series of overlapping single photon resonances. It is also possible to produce large changes in n by chirping the frequency backwards, in which case the population transfer occurs by a single multiphoton adiabatic passage, and only small frequency chirps are required. These process are all readily understood in terms of the evolution of the Floquet, or dressed energy levels during the microwave pulse. It is a pleasure to acknowledge the invaluable contributions of H. Maeda, D. V. L. Norum, and J. H. Gurian to this work. This work has been supported by the National Science Foundation.