MANIPULATING A CLASSICAL ELECTRON

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Exposing a Rydberg atom to a microwave field at its Kepler frequency phase locks the orbital motion of the electron to the microwave field. In quantum mechanical terms the phase locked motion is a non dispersing wavepacket in which the electron remains spatially localized for thousands of orbits, vastly longer than typical Rydberg radial wavepackets. These wavepackets are best described as Floquet, or dressed, eigenstates. Since the electron's motion is phase locked to the microwave field, if the microwave frequency is changed the electron's motion follows, with its motion maintaining the same phase relative to the microwave field. In quantum mechanical terms the process is adiabatic passage through a sequence of overlapping single photon trqnsitions. Changes in n of up to ten have been observed. It is also possible to replace the sequence of single photon transitions by a single multiphoton transition, enormously reducing the range of the frequency sweep required. This work has been supported by NSF under grants PHY-0244320 and CHE-0215957.