

## MANIPULATING RYDBERG ATOMS WITH MICROWAVES

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Using microwave fields at the Kepler frequency of a Rydberg atom it is possible to phase lock the motion of the Rydberg electron to the microwave field. The motion remains phase locked for thousands of orbits, producing a non dispersing wave packet. In particular, this has been done for  $n=70$  atoms in 17 GHz microwave fields. Since the electron's motion is phase locked to the microwave field, it is possible to speed up or slow down the orbital frequency by raising or lowering the microwave frequency. Using this technique we have moved atoms between  $n=70$  and 80 with microwave fields chirped between 13 and 19 GHz. In quantum mechanical terms the population transfer is an adiabatic rapid passage through overlapping avoided crossings of dressed energy levels. This way of looking at the problem suggests nonintuitive approaches which are also quite effective.