Collapse and revivals of wave-packets in optical lattices

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We study the effects of dispersion, tunneling and dissipation on wave-packet oscillations resembling coherent states of atoms in optical lattices. The wave-packets are prepared by suddenly shifting the lattice after equilibration of the atoms at the lattice sites. The atoms oscillate in the light-shift potential wells, which exert a force arising from photon redistribution between lattice beams.

We measure the resultant periodic intensity exchange between the beams, obtaining information on the wave-packet evolution. We observe a strong impact of dissipation on the overall shape and the time of revivals, as well as a suppression of tunneling by weak magnetic fields. Further applications of the technique will be discussed.