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Coherent control of matterwave diffraction: quantum resonance and the "ratchet" effect

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Abstract

When cold atoms are subject to pulses from an optical lattice, they diffract (or diffuse) until their motion saturates due to quantum interference. However, if the pulses are spaced by the Talbot time ballistic diffusion may occur without saturation. We have used a coherent source of matter waves (from a Bose-Einstein condensate) to control this coherent diffusion affect, with one application being directed diffusion (a "ratchet" effect). I will also discuss other possible applications of this form of coherent control.

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