

Manipulating the momentum state of a condensate by sequences of standing wave pulses

Xuguang Yue, Wei Xiong, Zhongkai Wang, Xiaoji Zhou, and Xuzong Chen

School of Electronics Engineering & Computer Science, Peking University, Beijing 100871, China

Coherent momentum manipulation is very important for splitting and recombining ultra-cold atoms in atomic interferometry, and the diffraction of atoms from standing wave light is an usual and effective method to achieve this goal. Here we show a method for flexible manipulation of the atomic momentum states, where the standing wave pulses are less limited in pulse intensities and durations than in cases of Bragg or Kapitza-Dirac diffraction. The diffraction of a Bose-Einstein condensate from one, two, three and four standing wave pulses are demonstrated in our experiments and systematically analyzed by the band structure theory of one-dimension optical lattice. With this method, we are able to design and realize several specific momentum states, which may be applied in atomic interferometry. In principle, this method could be used for designing a wide range of possible target states.