

Manipulation of Quantum Bose Gas in One Dimensional Optical Lattice

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It is reported in this paper that we controlled the super-radiant scattering in one dimensional optical lattice, plenty interested phenomena were observed. A Bose-Einstein condensate of 2×10^5 ^{87}Rb atoms is loaded adiabatically along its long axis into an optical lattice formed with a retro-reflected laser beam ($\lambda_L = 852\text{nm}$), focused on the BEC to a waist of $110 \mu\text{m}$. After holding a duration of 50 ms, we suddenly release the combined optical and magnetic traps. Following a delay Δ_t , a light pulse, red or blue detuned from the D_2 transition ($\lambda_S = 780 \text{ nm}$) by 1.3 GHz, is shined on the released matter waves. The suppression of superradiance and matter wave amplification (MWA) is observed (c), the phase transition appeared while the optical potential is increased to $34E_r$. Furthermore, we demonstrated the possibility of using matter wave amplification for characterizing spatial correlations of a Bose gas loaded in an optical lattice.

1. Xinxing Liu, et al., Phys. Rev. A 83, 063402 (2011).
2. Bo Lu et al., Phys. Rev. A 83, 051608(R) (2011).
3. Xinxing Liu et al., Phys. Rev. A 83, 063604 (2011).
4. Bo Lu et al., Phys. Rev. A 83, 033620 (2011).
5. Thibault Vogt et al., Phys. Rev. A 83.

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