# Nontrivial Bloch oscillations in photonic lattices with second-order coupling

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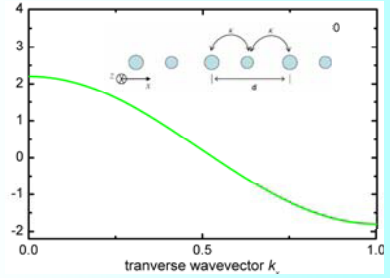
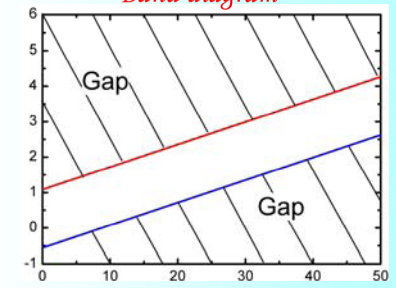
## Typical Bloch oscillations

### *Dispersion relation*



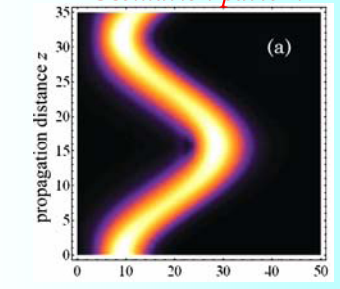

➢Dispersion relation of photonic lattices.

### *Band diagram*




➢Band diagram of photonic lattices with second-order couplings under the modulation of graded potential.

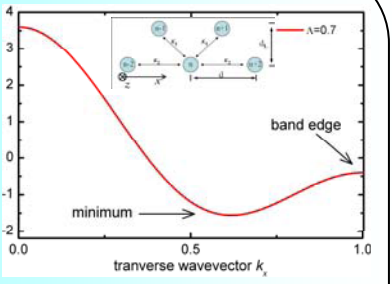
### *Oscillation pattern*




➢Typical oscillations pattern in linearly graded photonic lattices.

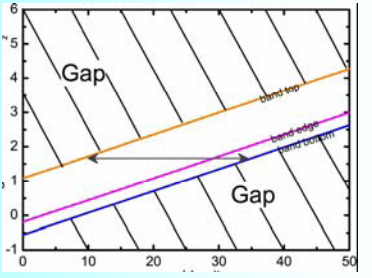
## Nontrivial Bloch oscillations

### *Dispersion relation*



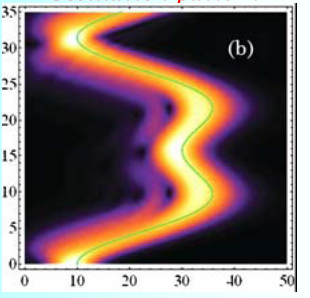

➢Dispersion relation of photonic lattices with second-order couplings.

### *Band diagram*




➢Band diagram of photonic lattices with second-order couplings under the modulation of graded potential.

### *Oscillation pattern*




➢Oscillations pattern in linearly graded photonic lattices with second-order couplings.

*Summary: To conclude, we have shown how the long-range interactions affect the BO. A double turning-back occurs when the beam approaches the band edge because of the derivation of the band bottom from the edge. The results can be extended to other periodic systems, e.g., cold atoms in optical lattices, because of the similar dynamic scheme owing to the periodicity[3].*

*References:*

1. *G. Wang, J. P. Huang, and K. W. Yu, Opt. Lett. (Accepted).*
2. *T. Pertsch, P. Dannberg, W. Elflein, A. Brauer, and F. Lederer, Phys. Rev. Lett. 83, 4752 (1999).*
3. *M. Ben Dahan, E. Peik, J. Reichel, Y. Castin, and C. Salomon, Phys. Rev. Lett. 76, 4508 (1996).*