# Synthetic magnetic field effects on neutral bosonic condensates in quasi three-dimensional anisotropic layered structures

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We discuss a system of dilute Bose gas confined in a layered structure of stacked square lattices (slab geometry). Derived phase diagram reveals a non-monotonic dependence of the ratio of tunneling to on-site repulsion on artificial magnetic field applied to the system. The effect is reduced when more layers are being added, which mimics a two- to quasi three-dimensional geometry crossover. Furthermore, we establish a correspondence between anisotropic infinite (quasi three-dimensional) and isotropic finite (slab geometry) systems that share exactly the same critical values, which can be an important clue for choosing experimental setups that are less demanding, but still leading to the identical results. Finally, we show that the properties of the ideal Bose gas in three-dimensional optical lattice can be closely mimicked by finite (slab) systems, when the number of two-dimensional layers is larger than ten for isotropic interactions or even less, when the layers are weakly coupled.

9.7 cm

13.4 cm

**Subject category :**
8. Other Topics

**Presentation mode :**
Poster

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