

Spontaneous Formation of Anti-ferromagnetic Vortex Lattice in a Fast Rotating BEC with Dipole Interactions

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Abstract: When a Bose-Einstein condensate is set to rotate, superfluid vortices will be formed, which finally condense into a vortex lattice as the rotation frequency further increases. We show that the dipole-dipole interactions renormalize the short-range interaction strength and result in a distinction between interactions of parallel-polarized atoms and interactions of antiparallel-polarized atoms. This effect may lead to a spontaneous breakdown of the rapidly rotating Bose condensate into a novel anti-ferromagnetic-like vortex lattice. The upward-polarized Bose condensate forms a vortex lattice, which is staggered against a downward-polarized vortex lattice. A phase diagram related to the coupling strength is obtained.

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Key words: Bose condensate, dipolar interaction, vortex lattice

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