

Numerical Study of Vortex Interactions in Bose-Einstein Condensation¹

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Abstract

The dynamics and interaction of quantized vortices in Bose-Einstein condensates (BECs) are investigated by using the two-dimensional Gross-Pitaevskii equation (GPE) with/ without an angular momentum rotation term. If all vortices have the same winding number, they would rotate around the trap center but never collide. In contrast, if the winding numbers are different, their interaction highly depends on the initial distance between vortex centers. The analytical results are presented to describe the dynamics of the vortex centers when $\beta = 0$. While if $\beta \neq 0$, there is no analytical result but some conclusive numerical findings are provided for the further understanding of vortex interaction in BECs. Finally, the dynamic laws describing the relation of vortex interaction in nonrotating and rotating BECs are presented.

Keywords: rotating Bose-Einstein condensation; Gross-Pitaevskii equation; angular momentum rotation; vortex interaction; vortex pair; vortex dipole.

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