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# Dynamics of Rotating Two-component Bose-Einstein Condensates and Its Efficient Computation[1]

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**Abstract**

In this paper, we investigate the dynamics of rotating two-component Bose-Einstein condensates (BEC) based on the coupled Gross-Pitaevskii equations (CGPEs) with an angular momentum rotation term and an external driving field, and propose an efficient and accurate method for numerical simulations. We prove the conservation of the angular momentum expectation, derive the dynamic laws for the density of each component and condensate widths, and analyze the dynamics of a stationary state with its center shifted from the trap center. By formulating the CGPEs in either 2D (two-dimensional) polar coordinate or 3D cylindrical coordinate system, the angular momentum rotation term becomes a term with constant coefficients. This allows us to develop an efficient time-splitting method which is time reversible, time transverse invariant, unconditionally stable, efficient and accurate for the problem. Moreover, it conserves the total position density in the discretized level. The numerical method is applied to verify our analytical results and study the dynamics of quantized vortex lattices in rotating two-component BEC with/without an external driving field.

**Keywords:** Rotating two-component Bose-Einstein condensation; coupled Gross-Pitaevskii equations; angular momentum rotation; condensate width; angular momentum expectation; quantized vortex lattice.

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