学术报告

An efficient and spectrally accurate numerical method for computing dynamics of rotating Bose－Einstein condensates

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Abstract： In this paper, we propose an efficient and spectrally accurate numerical method for computing the dynamics of rotating Bose-Einstein condensates (BEC) in two dimensions (2D) and 3D based on the Gross-Pitaevskii equation (GPE) with an angular momentum rotation term. By applying a time-splitting technique for decoupling the nonlinearity and properly using the alternating direction implicit (ADI) technique for the coupling in the angular momentum rotation term in the GPE, at every time step, the GPE in rotational frame is decoupled into a nonlinear ordinary differential equation (ODE) and two partial differential equations with constant coefficients. This allows us to develop new time-splitting spectral methods for computing the dynamics of BEC in a rotational frame. The new numerical method is explicit, unconditionally stable, and of spectral accuracy in space and second-order accuracy in time. Moreover, it is time reversible and time transverse invariant, and conserves the position density in the discretized level if the GPE does. Extensive numerical results are presented to confirm the above properties of the new numerical method for rotating BEC in 2D. This is a joint work with Prof. Bao Weizhu at National University of Singapore.

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