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Efficiently computing vortex lattices in rapid rotating Bose-Einstein condensates[1]

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Abstract

We propose an efficient and spectrally accurate numerical method for computing vortex lattices in rapid rotating Bose-Einstein condensates (BECs), especially with strong repulsive interatomic interaction. The key ingredient of this method is to discretize the normalized gradient flow by Fourier spectral method in space and by semi-implicit Euler method in time. Different vortex lattice structures of condensate ground states in two-dimensional (2D) and 3D rapid rotating BECs are reported for both harmonic and harmonic-plus-quartic potentials. In addition, vortex lattices in rotating BECs with optical lattice potentials are also presented.

Keywords: Gross-Pitaevskii equation; vortex lattices; strong repulsive interaction regime; angular momentum rotation.

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