Condensed Matter > Quantum Gases

Pitchfork bifurcations in blood-cell shaped dipolar Bose-Einstein condensates

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We demonstrate that the method of coupled Gaussian wave packets is a full-fledged alternative to direct numerical solutions of the Gross-Pitaevskii equation of condensates with electromagnetically induced attractive $1/r$ interaction, or with dipole-dipole interaction. Moreover, Gaussian wave packets are superior in that they are capable of producing both stable and unstable stationary solutions, and thus of giving access to yet unexplored regions of the space of solutions of the Gross-Pitaevskii equation. We apply the method to clarify the theoretical nature of the collapse mechanism of blood-cell shaped dipolar condensates: On the route to collapse the condensate passes through a pitchfork bifurcation, where the ground state itself turns unstable, before it finally vanishes in a tangent bifurcation.

Submission history

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