

Efficient algorithms for the time-dependent Gross-Pitaevskii equation with harmonic potentials

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The Gross-Pitaevskii equation (GPE), a non-linear Schrödinger equation, is the most commonly used equation to simulate the properties of Bose-Einstein condensates. We have developed efficient algorithms, based on a spectral method, to monitor the time evolution of condensates trapped in harmonic potentials. We also show how the Optimal Damping Algorithm [1] can be used to find the ground stationary state of the GPE. The application of these algorithms to various physically significant problems, in one, two, and three spatial dimensions, is illustrated and performance issues are discussed.

[1] E. Cancès and C. Le Bris, *Int. J. Quantum Chem.* **79**, 82 (2000).

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