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Optimal control of the dynamics of a BEC: optimizing splitting and squeezing[1] J. GROND, U. HOHENESTER, Inst. of Physics, Univ. Graz, G. VON WINCKEL, Inst. of Mathematics, Univ. Graz, A. SCRINZI, Arnold Sommerfeld Center, LMU Munich, J. SCHMIEDMAYER, Atominstitut, TU-Wien
— Number squeezed states are useful for atom interferometers and reduce phase diffusion in split Bose-Einstein condensates. In this paper we show that counter-intuitive splitting protocols allow efficient number squeezing on much shorter time scales compared to quasi-adiabatic splitting (J. Grond et al., Phys. Rev. A **80**, 053625 (2009)). This is achieved by controlling the interplay between tunneling and nonlinear interaction using optimal control theory (OCT) within the Multi-configurational time dependent Hartree equations for Bosons MCTDHB (O. E. Alon, et al., Phys Rev. A **77**, 033613 (2008)) method. We are seeking for maximal squeezing, while the condensates should be at rest and decoupled at the end of the splitting. We proceed with MCTDHB simulations with more than two modes. Condensate excitations are shown to affect number squeezing in some cases, but are found to be of little importance for our OCT control fields. From these results we obtain insight about the limits of two-mode descriptions.

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