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Author: Mr. Jan Teske
TU Darmstadt, Germany, jan.teske@physik.tu-darmstadt.de

Prof.Dr. Reinhold Walser
TU Darmstadt, Germany, Reinhold.Walser@physik.tu-darmstadt.de

WIGNER REPRESENTATION OF INTERACTING BECS IN THE THOMAS-FERMI LIMIT

Abstract

In 2017 the MAIUS sounding rocket created the first Bose-Einstein condensate (BEC) in space and realized a matter-wave interferometer. Potential applications for matter-wave devices in spaces are: high precision inertial sensing, e.g. for spacecraft navigation, as well as fundamental aspects like the weak Einstein's equivalence principle.
As in conventional optics, matter-wave experiments require far-reaching knowledge of different types of aberrations, such as non-perfect lenses and residual mean field interactions. Quantifying aberrations is done with classical mean fields or with ray tracings simulations in phase space in terms of the Wigner distribution. It is therefore necessary to have simple approximation schemes for BECs in the strong interacting regime (Thomas-Fermi limit) in phase space. In the present contribution, we compare an analytical approximation for the Thomas-Fermi Wigner functions with full Gross-Pitaevskii mean field simulations.