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Prototyping method for Bragg-type atom interferometers[1] BRANDON BENTON, MICHAEL KRYGIER, JEFFREY HEWARD, Georgia Southern University, MARK EDWARDS, Georgia Southern University and NIST, CHARLES CLARK, Joint Quantum Institute and NIST — We present a method for rapid modeling of new Bragg ultracold atom-interferometer (AI) designs useful for assessing the performance of such interferometers. The method simulates the overall effect on the condensate wave function in a given AI design using two separate elements. These are (1) modeling the effect of a Bragg pulse on the wave function and (2) approximating its evolution during the intervals between the pulses. The actual sequence of these pulses and intervals is then followed to determine the approximate final wave function from which the interference pattern can be calculated. The exact evolution between pulses is assumed to be governed by the Gross-Pitaevskii equation (GPE). We have developed both 1D and 3D versions of this method and have determined their validity by comparing their predicted interference patterns with those obtained by numerical integration of the 1D GPE and with the results of an experiment performed at NIST. We find good agreement between the 1D interference patterns predicted by this method and those found by the GPE. We show that we can reproduce the results of the NIST experiment and that this method provides estimates of 1D interference patterns 10,000 times faster than direct integration of the GPE.

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