Abstract Submitted
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Monte Carlo Wavefunction Simulation of a Matter Wave Interferometer[1] BRYNLE BARRETT, CARSON MOK, SCOTT BEATTIE, A. KUMARAKRISHNAN, Deparment of Physics and Astronomy, York University, Toronto ON, Canada M3J 1P3 — We present Monte Carlo wavefunction (MCWF) simulations to understand a single state atom interferometer used to measure the atomic recoil frequency with laser cooled atoms. In the experiment, a standing wave laser is pulsed on at $t = 0$ which creates a superposition of momentum states. At $t = T$, a second standing wave pulse diffracts the momentum states again so that a density grating is formed in the vicinity of $t = 2T$. This grating is associated with the interference of momentum states separated by $2\hbar k$. A traveling wave readout pulse is applied to the sample at this time and the backscattered light from the grating is detected as the signal. The MCWF approach is used to model several aspects of the experiment, such as the dependence of the signal on the laser intensity profile, pulse length and spontaneous emission. The MCWF method is a well-known approach for solving dissipation problems in quantum optics. The method is equivalent to a master equation approach, but the random nature of quantum jumps is simulated more directly using a Monte Carlo treatment.

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