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Decoherence Due to Light Scattering and Collisions on a Single State Atom Interferometer[1] S. BEATTIE, I. CHAN, A. KUMARAKRISHNAN, York University — We have measured the effects of light scattering and collisions on the signal from a single state atom interferometer that uses laser cooled ^{85}Rb. Two standing wave pulses separated by time T are used to diffract and rephase momentum states (corresponding to a single internal state) resulting in the formation of a density grating in the vicinity of $t = 2T$. The grating is detected by measuring an echo signal that represents the amplitude of light backscattered by a traveling wave. Decoherence due to light scattering and collisions reduces the timescale over which matter wave interference can be detected. To study the effects of light scattering, we apply both traveling wave and standing wave pulses at a variable time δt before grating formation at $t = 2T$ and measure the echo amplitude. In both cases, the matter wave interference shows a periodic dependence on δt that is consistent with theoretical predictions based on the Fourier transforms of the momentum distributions associated with the decohering pulses. We also present studies of dcoherence due to cw standing wave light and collisions by measuring the echo amplitude as a function of T.

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