Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Study the Effect of an Atom-Optics Kicked Rotor on a de Broglie Wave Atom Interferometer ALEXEY TONYUSHKIN, Harvard University, SAI-JUN WU, NIST, Gaithersburg, MD, MARA PRENTISS, Harvard University —
We experimentally study the impact of an atomic kicked rotor on the "echo" signal output of a de Broglie wave interferometer. We relate the kicked rotor induced decoherence in the interferometer signal to the perturbation induced decay of the quantum fidelity amplitude. There have been several experimental and theoretical studies of fidelity decay for a spin-echo perturbed by a kicked rotor. In contrast with such internal state experiments, in our implementation delta- function-like optical standing wave pulses act on external states creating an instantaneous phase-space displacement perturbation[1]. Depending on the initial conditions we observed two different regimes: perfect coherence preservation independent on the number and strength of pulses applied, and a fidelity decay freeze at a finite value after just a small number of kicks at quantum resonance conditions of a quantum kicked rotor[2]. We also discuss the transition from a classical (vanishing kicking period case) to a quantum delta kicked rotor model. The observed effects may have applications in precision measurements.

[1]C. Petitjean, *et al.*, Phys. Rev. Lett. **98**, 164101 (2007)
[2]S. Wu, A. Tonyushkin, and M. G. Prentiss, arXiv:0801.0475v1

Alexey Tonyushkin
Harvard University

Date submitted: 31 Jan 2008 Electronic form version 1.4