Inertially sensitive light pulse atom interferometry at short interrogation times

DAVID BUTTS, KRISH KOTRU, Massachusetts Institute of Technology, JOSEPH KINAST, BRIAN TIMMONS, RICHARD STONER, C.S. Draper Laboratory, Inc.

— The use of cold atoms in any sensor operating in a dynamic environment requires that the measurement cycle be conducted before the atom cloud escapes the interaction region. Under multiple-g accelerations, it is desirable to complete measurements in millisecond time scales, especially when laser beams are used to interrogate the atoms. We demonstrate high-contrast atom interferometry in a small vapor cell using stimulated Raman transitions at millisecond interrogation times. Laser-cooled cesium atoms are interrogated with a sequence of three Raman pulses and the interferometer phase is read out in the same region in which the atoms are trapped. Our system achieved over 70% contrast with a Doppler insensitive interferometer and over 40% contrast with a Doppler sensitive interferometer, in an environment normally considered adverse to high-contrast atom interferometry (e.g., no retroreflector stabilization and no magnetic shielding).

We also report evidence of a potential inertial sensor error mechanism and present a method for inertial sensor scalefactor enhancement at short interrogation times.

David Butts
Massachusetts Institute of Technology

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