Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Effective inertial frame in an atom interferometric test of the equivalence principle CHRIS OVERSTREET, PETER ASENBAUM, TIM KOVACHY, REMY NOTERMANS, JASON M. HOGAN, MARK A. KASEVICH, Stanford University — In an ideal test of the equivalence principle, the test masses fall in a common inertial frame. A real experiment is affected by gravity gradients, which introduce systematic errors by coupling to initial kinematic differences between the test masses. We reduce the sensitivity of a dual-species atom interferometer to initial kinematics by using a frequency shift of the middle pulse to create an effective inertial frame for both atomic species. This suppresses the gravity-gradient-induced dependence of the differential phase on initial kinematic differences by two orders of magnitude and enables a precise measurement of these differences. We realize a relative precision of 3×10^{-11} per shot and reduce systematic errors associated with the gravity gradient to below one part in 10^{13}, paving the way for an atomic test of the equivalence principle at an accuracy comparable with state-of-the-art classical tests.

Chris Overstreet
Stanford University

Date submitted: 26 Jan 2018 Electronic form version 1.4