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A Robust Ramsey Interferometer for Atomic Timekeeping in Dynamic Environments KRISH KOTRU, MIT Department of Aeronautics and Astronautics, JUSTIN BROWN, DAVID BUTTS, JENNIFER CHOY, Draper Laboratory, MARISSA GALFOND, MIT Department of Aeronautics and Astronautics, DAVID M. JOHNSON, JOSEPH KINAST, BRIAN TIMMONS, RICHARD STONER, Draper Laboratory — We present a laser-based approach to atomic timekeeping, in which atomic phase information is extracted using modified Raman pulses in a Ramsey sequence. We overcome systematic effects associated with differential AC Stark shifts by employing atom optics derived from Raman adiabatic rapid passage (ARP). ARP drives coherent transfer between two hyperfine ground states by sweeping the frequency difference of two optical fields and maintaining a large single-photon detuning. Compared to fixed-frequency Raman transitions, ARP atom optics afford a $\sim$100x reduction in sensitivity to differential AC Stark shifts in a Ramsey interferometer. We also demonstrate that ARP preserves fringe contrast in Ramsey interferometers for cloud displacements reaching the $1/e^2$ intensity radius of the laser beam. ARP can thus be expected to improve the robustness of clock interferometers operating in dynamic environments.

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