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Using an Atom Interferometer to Measure Changes in Tune-Out Wavelength caused by Rotation and Acceleration RAISA TRUBKO, JAMES GREENBERG, MICHAEL T. ST. GERMAINE, MAXWELL D. GREGOIRE, IVAN HROMADA, WILLIAM F. HOLMGREN, ALEXANDER D. CRONIN, University of Arizona — Measurements of tune-out wavelengths made with an atom interferometer are shown to change by 150 pm due to inertial displacements. Because tune-out wavelengths can be measured with picometer precision in our laboratory, we explore how to use shifts in tune-out wavelengths to measure rotation rates with respect to an inertial frame. For example, measuring the earth's rotation rate with an uncertainty of 1% appears possible with this technique. The origin of shifts in measured tune-out wavelengths ($\lambda_{zero,\,lab}$) as compared to tune-out wavelengths in an inertial frame (λ_{zero}) is explained by dispersive inertial phase shifts, the vector dynamic polarizability $\alpha^v(\omega)$, and dispersion compensation. An atom beam with a velocity spread and an ensemble of atomic spin states is required. Because accurate measurements of λ_{zero} can be used for reporting ratios of dipole matrix elements, we also discuss methods for reducing systematic errors in measurements of λ_{zero}.

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