DAMOP14-2014-000878

Abstract for an Invited Paper
for the DAMOP14 Meeting of
the American Physical Society

Atom Interferometric Measurements of Atomic Structure

ALEX CRONIN, University of Arizona

Measurements of atomic polarizability, tune-out wavelengths, and van der Waals potentials made with an atom interferometer all serve as benchmark tests for atomic structure calculations. We used a Pritchard-type atom interferometer with phase shifts caused by electric field gradients in order to measure electric polarizabilities of Na, K, and Rb atoms [1]. We reported ratios of static polarizabilities α_{Rb}/α_{Na} =1.959(5) with 0.3 percent uncertainty. We studied atomic phase shifts due to laser light in order to measure a tune-out wavelength (where there is a root in dynamic polarizability) for potassium atoms of λ_{zero} =768.9712 nm with 1.5 pm uncertainty [2]. Finally, we measured atom-surface interactions with 2 percent precision, which was sufficient to detect the impact of Rb atomic core electrons on van der Waals potentials [3]. These serve as independent benchmarks for atomic structure calculations because polarizability depends on sums of oscillator strengths, tune-out wavelengths depend on ratios of oscillator strengths, and atom-surface van der Waals interactions depend on sums of oscillator strengths weighted by resonance frequencies. Advances in the atom interferometry measurement techniques used for these and next generation measurements will be discussed.

[1] Phys Rev A 81, 053607 (2010)
[2] Phys. Rev. Lett. 109, 243004 (2012)
[3] Phys. Rev. Lett. 105, 233202 (2010)