Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Precision Measurement of Transition Matrix Elements via Light Shift Cancellation CRESTON HEROLD, VARUN VAIDYA, XIAO LI, STEVEN ROLSTON, TREY PORTO, Joint Quantum Institute, University of Maryland and NIST, MARIANNA SAFRONOVA, Department of Physics and Astronomy, University of Delaware — We present a method for accurate determination of atomic transition matrix elements at the 10^{-3} level. Measurements of the ac Stark (light) shift around "magic-zero" wavelengths, where the light shift vanishes, provide precise constraints on the matrix elements. We make the first measurement of the $5s$-$6p$ matrix elements in rubidium by measuring the light shift around the 421 nm and 423 nm zeros through diffraction of a Bose-Einstein condensate off a sequence of standing wave pulses. In conjunction with existing theoretical and experimental data, we find 0.3235(9) ea_0 and 0.5230(8) ea_0 for the $5s$-$6p_{1/2}$ and $5s$-$6p_{3/2}$ elements, respectively, an order of magnitude more accurate than the best theoretical values. This technique can provide needed, accurate matrix elements for many atoms, including those used in atomic clocks, tests of fundamental symmetries, and quantum information.

Creston Herold
Joint Quantum Institute, University of Maryland and NIST

Date submitted: 25 Jan 2013 Electronic form version 1.4