Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Observation of Deeply-Bound $^{85}Rb_2$ Vibrational Levels Using Feshbach Optimized Photoassociation SEAN KRZYZEWSKI, TOM AKIN, JAMES DIZIKES, MICHAEL MORRISON, ERIC ABRAHAM, University of Oklahoma — We demonstrate Feshbach optimized photoassociation (FOPA) into the $0_g^-(5S_{1/2} + 5P_{1/2})$ state in $^{85}Rb_2$. FOPA uses the enhancement of the amplitude of the initial atomic scattering wave function due to a Feshbach resonance to increase the molecular formation rate from photoassociation. We observe three vibrational levels, $v = 127$, 140, and 150, with previously unmeasured binding energies of 256, 154, and 96 cm^{-1}. We measure the frequency, central magnetic field position, and magnetic field width of each Feshbach resonance. Our findings experimentally confirm that this technique can measure vibrational levels lower than those accessible to traditional photoassociative spectroscopy. We present theory concerning the polarization dependence of FOPA for this system, and discuss implications of using this system to measure the time-variation of the electron/proton mass ratio.

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Date submitted: 29 Jan 2016 Electronic form version 1.4