P6 54 Transitions among H Stark substates induced by time-varying, weak static electric fields* A. BUTZ, P.M. KOCH, K.D. SCHULTZ, J. WILSON, *SUNY Stony Brook* Our laboratory produces H Rydberg atoms (typically 14 keV) with a collision/laser method. H^+-Xe collisions produce $H(n)$ atoms. A 100 kV/cm field ionizes $n > 9$. In F_1 near 30 kV/cm, a CO_2 laser transfers 50% of $(n,n_1,|m|) = (7,0,0)$ atoms to $(10,0,0)$ (or other chosen substate). They fly through F_2 and are excited in F_3 with a CO_2 laser from $n = 10$ substates to $n > 24$ substates. Each F is transverse between parallel plates, but we separately control the voltage to all six plates. If all F_i are parallel and F_2, F_3 exceed a few V/cm, population stays on the $(10,0,0)$ substate, and we get a 'simple' excitation spectrum in F_3. If F_2 or F_3 (or both) is too weak or antiparallel, we detect new excitation peaks in F_3 from atoms moved into other $n = 10$ substates. Our experimental goal is careful, quantitative measurements and interpretation of these excitation spectra to understand where the population goes. Our theoretical goal is a model for this process similar to that for Majorana depolarization of magnetic substates in Lamb-shift polarized ion sources[1].

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[1]G.G. Ohlsen, Los Alamos Report LA-3949 (1968); W.J. Thompson, Nucl. Instr. Meth. A **333**, 443 (1993).

P6 55 Transient Phase-Space Localization of Quasi-One-Dimensional Rydberg Wavepackets C.L. STOKELY, F.B. DUNNING, *Department of Physics and Astronomy and the Rice Quantum Institute, Rice University* A.K. PATTANAYAK, *Department of Physics and Astronomy, Carleton College and Department of Physics and Astronomy and the Rice Quantum Institute, Rice University* D.G. ARBO, *Department of Physics, University of Tennessee, Knoxville* C.O. REINHOLD, *Physics Division, Oak Ridge National Laboratory and Department of Physics, University of Tennessee, Knoxville* J. BURGDORFER, S. YOSHIDA, *Institute for Theoretical Physics, Vienna University of Technology* The problem of producing a specific targeted Rydberg wavepacket can be greatly simplified by first localizing the initial wavepacket in phase-space before subsequently manipulating it to obtain the desired final state. Such localization can be accomplished using the extreme states in a Stark manifold, which behave as quasi-one-dimensional atoms, and then applying an untrashort half-cycle pulse (HCP). Such HCPs simply deliver a "kick" to the excited electron. Classical and quantum calculations show that the resulting wavepacket undergoes strong periodic transient simultaneous localization in both momentum and position. This phase-space localization corresponds to an increase in the coherence of the system, which is analyzed using the course-grained entropy. The coarse graining of the quantum system is performed by considering its Husimi phase-space distribution. The phase-space localization can also be "trapped" for extended periods using a train of subsequent kicks. Very-high-n potassium Rydberg atoms are being used to examine phase-space localization experimentally. *Work supported by the NSF, DOE, and Robert A. Welch Foundation

P6 56 Long-Lived Stark States of He above the Classical Ionization Threshold HERIC FLORES-RUEDA, DAVID WRIGHT, WEN HUANG, RODERICK JENSEN, THOMAS MORGAN, *Wesleyan University* We have isolated and observed long-lived Stark Rydberg states of helium above the classical ionization limit. Using field ionization we have detected states that survive for longer than about 0.5 microseconds, by allowing the Rydberg atoms to drift in vacuum after above-threshold excitation. In the case of m = 0 singlet and triplet states and m = 1 triplet states, the levels disappear essentially at the classical ionization limit. However, for m = 1 singlet states with very small quantum defect (0.012) the levels survive well above threshold. Remarkably, the red (downhill) Stark states exhibit greater survival above threshold than the blue (uphill) states. Work supported by the National Science Foundation.

P6 57 Measurement of the ray-splitting correction to the Weyl formula* C. VAA, P.M. KOCH, *SUNY Stony Brook* R. BLUEMEL, *Wesleyan Univ.* Ray splitting (RS) is a universal phenomenon that occurs when properties of a wave system change on a scale smaller than a wavelength[1]. We use quasi-2d microwave cavitites with dielectric inserts as an experimental analog to quantal RS billiards[2]. We load our rectilinear ($l = 82.5$ cm, $w = 96$ cm) and 'thin' ($h = 4.37$ cm) cavity with two paraffin-wax, w- and h-filling bars ($\epsilon_{measured} = 2.25$) with respective widths 18 cm and 19 cm. We measure complete spectra up to about 1.3 GHz for different, but parallel, positions of the wax bars. From the data we obtain the RS correction fo the Weyl formula[3]. We will present our most recent results for the RS correction and compare it with theoretical predictions[4].

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[1]L. Couchman et al., Phys. Rev. A **46**, 6193 (1992).
[2]L. Sirko et al., PRL **78**, 2940 (1997); R. Bluemel et al., Found. Phys. **31**, 269 (2001).
[3]R.E. Prange et al., Phys. Rev. E **53**, 207 (1966).
[4]A. Kohler and R. Bluemel, Ann. Phys. (N.Y.) **267**, 249 (1998).

P6 58 The Stark Ball K.B. MACADAM, *U. Kentucky* C.S. HWANG, *Korean Air Force Academy* A compact prototype device has been constructed and mathematically modeled for collisional and optical studies that provides a uniform electric field – or electric-multipole field of high order – in a region exceeding 1 cm^3 which can be electronically switched to any direction (theta,phi) at sub-microsecond speeds. This "Stark Ball" consists of a 50-mm-dia. spherical cavity in a solid conducting shell accessible by straight-through 9-mm-dia. paths along x, y and z axes, into which 24 identical rods protrude symmetrically. Their rounded tips define a 25-mm-dia. empty spherical region. Arbitrary potentials may be applied to the individual rods. The device is non-magnetic, UHV-compatible, and nano-scalable, and it can be used from DC to microwave frequencies. Finite-element calculations at 200^3 resolution have given a complete description of fringing fields, central uniformity and potential surfaces for arbitrary applied potentials. This device generalizes the Stark barrel [Horn et al, Rev. Sci. Instrum. vol. 69, 4086 (1998)] to three dimensions. Supported in part by NSF Grant PHY-9987954.

P6 59 Even parity Rydberg states of bismuth K. BARANOWSKI,* *Physics Department, College of William and Mary* L. NG, *Physics Department, College of William and Mary* W.E. COOKE, *Physics Department, College of William and Mary* We report two-photon excitation of $nd_{3/2}$, $nd_{5/3}$, and ns Rydberg states of bismuth in an atomic beam. Our measurements extend the range of n states from what has previously been reported, especially for the ns states.

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