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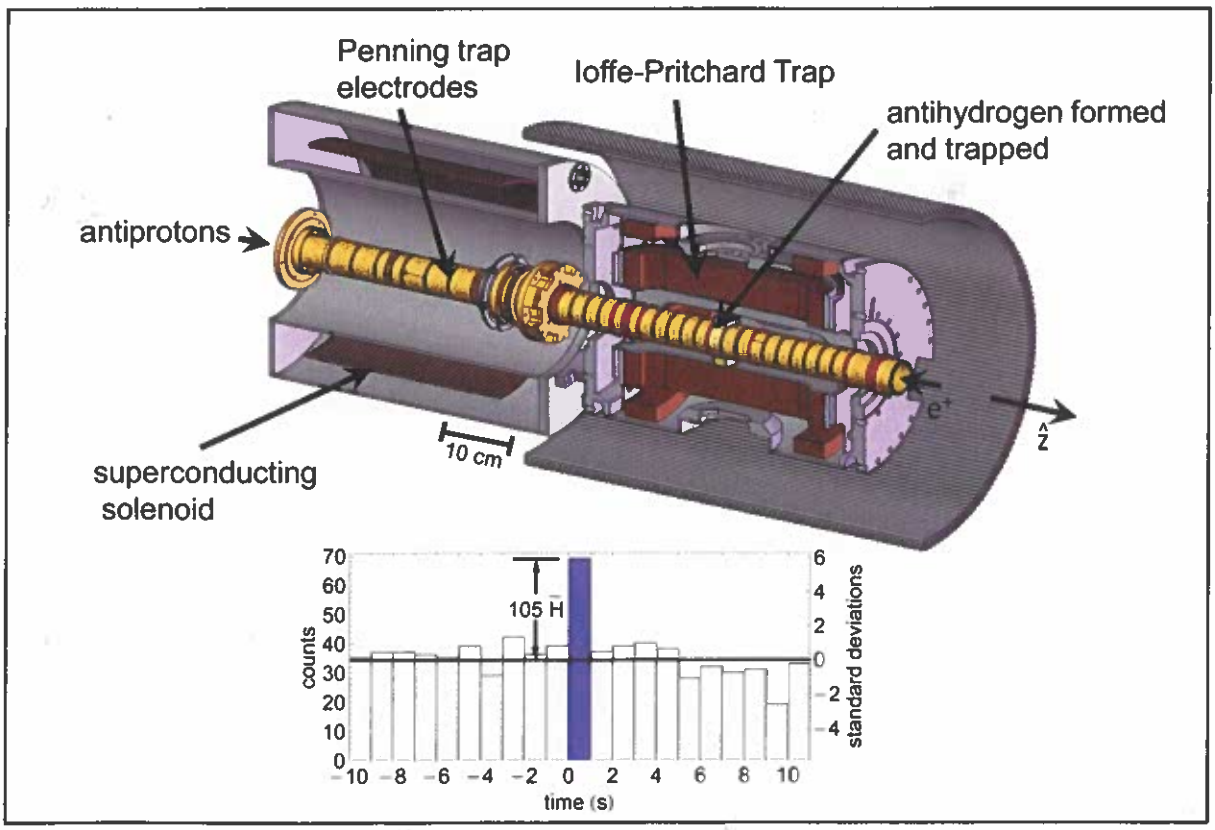

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the electron, but also the intermediate-state electron wave packet at energies in the vicinity of the barrier. Such effects have been demonstrated numerically as a function of frequency in two-photon ionization processes [1]. Here we show that these effects are quite general by considering the multiphoton cross sections for ionization of Ar and Xe within a single-active-electron, central-potential model.

*This work is supported in part by DOE, Office of Science, Division of Chemical Sciences, Geosciences, and Biosciences, under Grant No. DE-FG03-96ER14646.

[1] L.W. Pi and A.F. Starace, Phys. Rev. A **82**, 053414 (2010).

11:42

N4 7 Photoionization and Electron-Ion Recombination of Ar XVI and Ar XVII* SULTANA NAHAR,† *Ohio State U* Results on photoionization and electron-ion recombination of Ar XVII and Ar XVII obtained from unified method will be reported. The method, based on relativistic Breit-Pauli R-matrix method and close-coupling approximation, (i) subsumes both the radiative and dielectronic recombination and (ii) provides self-consistent sets of photoionization and recombination cross sections, σ_{PI} and σ_{RC}. Important features for level-specific σ_{PI} and recombination rate coefficients (α_R), such as for diagnostic w, x, y, z X-ray lines of Ar XVII in the ultraviolet region of astrophysical spectra will be illustrated. Monochromatic decay dominates the low energy photoionization and low temperature recombination rates. However, high energy resonances in σ_{PI} introduce a DR bump at high temperature recombination. While the 1s-2p core excitations enhance the background of $\sigma_{PI}(nSLJ)$ at n = 2 thresholds. the resonances become much weaker beyond them. The extensive sets of results correspond to fine structure levels with $n \leqslant 10$ and $0 \leqslant l \leqslant 9$. They include 98 levels of Ar XVI of total angular momenta $1/2 \leqslant J \leqslant 17/2$ and 191 levels of Ar XVII of $0 \leqslant J \leqslant 9$. The present $\alpha_R(T)$ with temperature show good agreement with ava.

*Partial support: NSF, DOE
†Presentation in PDF

11:54

N4 8 Ionization of Excited Atoms in Intense, Low Frequency Single-Cycle Fields SHA LI, ROBERT JONES, *University of Virginia* We have employed intense THz pulses to explore strong-field, single-cycle ionization of low-lying Rydberg states in the low-frequency limit. In contrast to the ground-state atoms commonly used as targets for intense laser experiments, excited atoms and polar molecules can exhibit large linear Stark shifts in the presence of static or slowly varying fields. These shifts can have a significant effect on the ionization probability and dynamics in the field. In the experiments, sodium Rydberg atoms are laser-excited using two ns dye lasers and then exposed to a single-cycle, ps THz pulse produced via optical rectification in LiNbO3 of a tilted pulse front, 100 fs, 780 nm laser pulse. A time-of-flight spectrometer is used to record the ionization yield and energy distribution of the ejected electrons as a function of principal quantum number and the THz field strength. The measurements are compared with those of previous experiments on long-pulse microwave and ramped-field ionization of higher-lying Rydberg states and with the results of classical Monte Carlo simulations.

12:06

N4 9 Interatomic Coulombic Decay (ICD) in deep inner-shell vacancy cascades* D. RAY, R.W. DUNFORD, S.H. SOUTHWORTH, E.P. KANTER, B. KRAESSIG, L. YOUNG, D.A. ARMS, E.M. DUFRESNE, D.A. WALKO, *X-Ray Science Division, Argonne National Laboratory* O. VENDRELL, S.-K. SON, R. SANTRA,† *Center for Free-Electron Laser Science, DESY, Germany* The photoionization of an inner-shell electron in a heavy atom triggers a vacancy cascade with the emission of x-ray fluorescence and Auger electrons leading to its final charge states. If the atom is part of a molecule or cluster, the decay process may involve removal of the valence electrons on the neighboring atoms thereby forming several charge centers and resulting in the Coulomb explosion of the system. This phenomenon in molecules where the valence electrons on the neighboring atoms play a significant role in the decay process is called Interatomic Coulombic Decay (ICD) [1]. The focus of this work is to explore the ICD effect in XeF_2 [2] following K-shell ionization of the Xe atom near 34.5 keV. We compare the total charge produced following Xe Kα or Kβ fluorescence decay from atomic Xe and from Xe in XeF_2 molecules. We present both experimental and calculational evidence that the fluorine atoms get involved in the decay process and the molecules start undergoing structural changes during the vacancy cascade.

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†Department of Physics, University of Hamburg, Germany

[1] L. S. Cederbaum *et al.*, Phys. Rev. Lett. **79**, 4778 (1997).
[2] C. Buth *et al.*, J. Chem. Phys. **119**, 10575 (2003).

SESSION N5: OPTOMECHANICAL SYSTEMS AND ELECTROMAGNETICALLY-INDUCED TRANSPARENCY

Thursday Morning, 7 June 2012
Room: Garden 3 at 10:30
Junho Suh, California Institute of Technology, presiding

Contributed Papers

10:30

N5 1 Quadratically-coupled optomechanical systems: spectrum and dynamics M. BHATTACHARYA, H. SHI, *Department of Physics, Rochester Institute of Technology, Rochester, NY 14623* Optomechanical systems, which commonly involve a high finesse optical cavity coupled to the linear displacement of a mechanical oscillator, are currently of great interest for applications in quantum information, communication and measurement. Recently instead, a coupling quadratic in the mechanical displacement has been engineered in various systems. These include resonator setups with membranes, cold atoms and microdisks. Neglecting at first dissipation and noise, we present the exact eigenstates of the generic quadratic optomechanical Hamiltonian, examine the corresponding spectrum in the limit of strong coupling, quantify the bipartite entanglement in the system, and describe the unitary-evolution as well as measurement-based engineering of nonclassical states of the system. We show that several of our results are in qualitative contrast with those from the case of linear optomechanical coupling and address briefly the presence of dissipation and the case of quartic coupling recently realized using a tilted membrane in a cavity.

10:42

N5 2 Macroscopic tunneling of a membrane in an optomechanical double-well potential* LUKAS BUCHMANN, *University of Arizona* LIN ZHANG, *Shaanxi Normal University* ARAVIND