Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

First demonstration of high-precision Ramsey-comb spectroscopy in the VUV spectral range LAURA DREISSEN, CHARLAINE ROTH, ELMER GRUNDEMAN, MAXIME FAVIER, JULIAN KRAUTH, KJELD EIKEMA, LaserLaB, Vrije Universiteit Amsterdam — High-precision spectroscopy of simple atomic systems, such as atomic hydrogen, enables stringent tests of bound-state quantum electrodynamics (QED). Frequency measurements on e.g. singly-ionized helium could provide more stringent tests, enable a new determination of the Rydberg constant or the alpha particle charge radius. For this purpose, we developed precision frequency metrology at vacuum-UV (VUV) and shorter wavelengths by combining Ramsey-Comb Spectroscopy (RCS) with High-Harmonic Generation (HHG) for the first time. In RCS, the transition frequency is determined from the phase of Ramsey fringes recorded with pairs of amplified frequency-comb pulses at different multiples of the comb repetition time. A combination with HHG could introduce detrimental phase shifts from plasma formation. We show this is circumvented by introducing a minimum pulse delay of 16ns, and demonstrate a measurement of the 5p$\rightarrow$8s transition xenon at 110nm (7^{th} harmonic) with a preliminary relative accuracy of $<5*10^{-10}$ ($\approx$1MHz, more than a 1000-fold improvement on the transition). The accuracy is mainly limited by the transit time of xenon through the refocused VUV beam and shows that this method is very promising for precision metrology of the 1S-2S transition in He^+.

Laura Dreissen
Vrije Universiteit

Date submitted: 31 Jan 2019 Electronic form version 1.4