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Development of 243.1 nm Radiation Source for Laser Cooling and Performing Spectroscopic Measurements of Hydrogen CORY RASOR, ZAK BURKLEY, SAMUEL COOPER, ADAM BRANDT, DYLAN YOST, Colorado State University — Measurements of the hydrogen 1S-2S transition have resulted in precise determinations of the Rydberg constant, Lamb shift, and proton charge radius. Such measurements, in conjunction with the spectroscopy of other hydrogen transitions, can ultimately test bound-state quantum electrodynamics. Currently, it is also of great interest to measure the 1S-2S transition in anti-hydrogen, since it can now be produced and trapped in its ground state. The excitation of the 1S-2S transition in both hydrogen and anti-hydrogen requires highly coherent laser radiation at 243 nm and power-scaled laser sources at this wavelength would enable more versatile measurement techniques. Therefore, this talk will discuss the development of a 243 nm radiation source, which consists of an extended-cavity-laser-diode at 972 nm, followed by a tapered amplifier, a Yb-fiber amplifier, and two consecutive resonant doubling cavities yielding ≈600 mW of continuous-wave power. When enhanced within an optical cavity, this source may even be sufficient for two-photon laser cooling of atomic hydrogen. Such a scheme would circumvent some difficulties that arise in single photon cooling using 121.6 nm radiation.

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