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# Two Photon Direct Frequency Comb Spectroscopy of the 1S-3S Transition in Hydrogen

*Monday 3 July 2023 21:00 (2 hours)*

The energy levels of hydrogen-like systems can be both calculated and measured very precisely. Precision spectroscopy of two transitions at the current level of accuracy allows the determination of the Rydberg constant and the proton charge radius. Comparison with an additional transitions can serve as a consistency check for the theory of quantum electrodynamics. The recent discrepancy in these consistency checks is known as the proton size puzzle.
I will present the latest measurement of the 1S-3S transition in hydrogen, using two photon direct frequency comb spectroscopy and explain the experimental technique along with our setup. The obtained result ( f1S-3S = 2,922,743,278,665.79(72) kHz) supports the value of the proton charge radius first obtained from muonic hydrogen. The difference of 2.1 standard deviations of this result and the last measurement of the same transition suggests that the proton size puzzle can be resolved by further investigating the experimental uncertainties. We will give an outlook on the next anticipated measurements, current problems and recent improvements of the experiment.

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