

A revised value of the Rydberg constant from muonic and electronic atoms

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Laser spectroscopy of muonic hydrogen [1,2] yielded a proton rms charge radius which is 4% (or ~6 sigmas) smaller than the CODATA value [3]. Also the deuteron charge radius from muonic deuterium [4] is 6 sigmas smaller than the CODATA value, but consistent with the smaller proton inside the deuteron.

These smaller charge radii, when combined with precision measurements of the 1S-2S transitions in regular (electronic) hydrogen [5] and deuterium [6], yield a 6 sigmas smaller value of the Rydberg constant [7], compared to the CODATA value.

In this talk I will report about a new measurement of the Rydberg constant from the 2S-4P transition in regular hydrogen performed in Garching [8], which supports the smaller, “muonic” value. I will also discuss the measurements in muonic hydrogen, deuterium, and helium, and the consequences for the “proton radius puzzle”.

- [1] Pohl et al. (CREMA Coll.), Nature 466, 213 (2010)
- [2] Antognini et al. (CREMA Coll.), Science 339, 417 (2013)
- [3] Mohr et al. (CODATA 2014), Rev. Mod. Phys. 88, 035009 (2016)
- [4] Pohl et al. (CREMA Coll.), Science 353, 669 (2016)
- [5] Parthey et al., PRL 107, 203001 (2011)
- [6] Parthey et al., PRL 104, 233001 (2010)
- [7] Pohl et al., Metrologia 54, L1 (2017)
- [8] Beyer et al., submitted (2017).

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