

GSI - FAIR Colloquium

KBW Lecture Hall (KBW 1.017), 64291 Darmstadt, Planckstraße 1

*Tuesday, January 31, 2017,
16:15 Uhr (Tee ab 15:45)*

Pre-colloquium for students at 15:30

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Laser spectroscopy for nuclear physics and fundamental constants

For more than a decade, the rms charge radius of the proton was known to be 0.88fm, with about 1% uncertainty [1]. Two methods, elastic electron scattering and precision laser spectroscopy of atomic hydrogen, yielded consistent values.

In 2010, our result from laser spectroscopy of the exotic "muonic hydrogen" atom yielded a 4% smaller value, 0.84 fm, with an uncertainty of less than 0.1% [2,3]. In muonic hydrogen, a negative muon orbits a proton with a 200 times smaller Bohr orbit than in regular hydrogen, which increases the sensitivity of muonic hydrogen to the proton charge radius by $200^3 \sim 10$ million! Since 2010, the discrepancy increased to more than 7 sigmas [4], making it one of the biggest discrepancies in the Standard Model.

I will discuss the so-called "proton radius puzzle" [5], report on more measurements in muonic atoms [6], and the result of a new measurement in regular atomic hydrogen.

[1] P.J. Mohr et al. (CODATA 2006), Rev. Mod. Phys. 80, 633 (2008)

[2] Pohl et al. (CREMA coll.), Nature 466, 213 (2010)

[3] Antognini et al.,(CREMA coll.), Science 339, 417 (2013)

[4] Olive et al. (PDG 2014), Chin. Phys. C40, 090001 (2014)

[5] Pohl et al., Annu. Rev. Nucl. Part. Sci 63, 175 (2013)

[6] Pohl et al. (CREMA coll.), Science 353, 669 (2016)

Einladender: Wolfgang Quint

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