

The MUSE Experiment: A Study of the "Proton Radius Puzzle" with simultaneous mu-p and e-p Elastic Scattering

The controversy over the significant difference between the determination of proton radius using high-precision muonic hydrogen techniques and from electronic scattering and atomic measurements is called the "Proton Radius Puzzle" (PRP). The resolution of the puzzle remains unclear and appears to require new experimental results. The MUSE Collaboration will perform an experiment at the Paul Scherrer Institut (PSI) to make simultaneous measurements of muon-proton and electron-proton elastic scattering in an attempt to resolve the PRP.

Summary

The Proton Radius Puzzle stems from a radius determined from atomic muonic hydrogen of 0.84184 ± 0.00067 fm,[1] and later updated to 0.84087 ± 0.00039 fm.[2] The CODATA 2006 value, based mainly on atomic hydrogen measurements is 0.8768 ± 0.0069 fm[3]. This has been confirmed by new electron scattering experiments[4,5] and re-analysis of existing data[6-8]. The current CODATA value is 0.8775 ± 0.0051 fm.[9]

1. R. Pohl et al., Nature 466, 213–216 (2010).
2. A. Antognini et al. Science 339, 417–420 (2013).
3. P. J. Mohr, B. N. Taylor, and D. B. Newell, Rev.Mod.Phys. 80, 633–730 (2008), 0801.0028.
4. J. Bernauer, et al., Phys.Rev.Lett. 105, 242001 (2010), 1007.5076.
5. X. Zhan, et al., Phys.Lett. B705, 59–64 (2011), 1102.0318.
6. I. Sick, Few Body Syst. 50, 367–369 (2011).
7. I. Sick, Prog.Part.Nucl.Phys. 67, 473–478 (2012).
8. R. J. Hill, and G. Paz, Phys.Rev. D82, 113005 (2010), 1008.4619.
9. P. J. Mohr, B. N. Taylor, and D. B. Newell (2012), 1203.5425.

Primary author: Dr BRISCOE, William (The George Washington University)

Presenter: Dr BRISCOE, William (The George Washington University)

Track Classification: Muon Physics