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The proton charge radius

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We have obtained a very accurate proton charge distribution radius by measuring the 2s-2p Lamb shift in muonic hydrogen[1]. The value we found, 0.84184(67)fm is roughly 10 times more accurate than the ones derived from either hydrogen spectroscopy or electron-proton elastic scattering. It is 5 standard deviations away from the CODATA 2008 value 0.8768(69) fm, which combines both types of measurements. The disagreement with the recently posted CODATA 2010 value 0.8775(51) fm [2] is even larger at 6.9 standard deviations. I will describe the experiment and the latest results on the other hyperfine component that we measured. I will discuss the latest theoretical evaluations and the implications of such a large disagreement, which has not been explained up to now.

[1] The size of the proton, R. Pohl, A. Antognini, F. Nez, F.D. Amaro, F. Biraben, J.M.R. Cardoso, D.S. Covita, A. Dax, S. Dhawan, L.M.P. Fernandes, A. Giesen, T. Graf, T.W. Hänsch, P. Indelicato, L. Julien, C.-Y. Kao, P. Knowles, E.-O.L. Bigot, Y.-W. Liu, J.A.M. Lopes, L. Ludhova, C.M.B. Monteiro, F. Mulhauser, T. Nebel, P. Rabinowitz, J.M.F. dos Santos, L.A. Schaller, K. Schuhmann, C. Schwob, D. Taqq, J.F.C.A. Veloso and F. Kottmann. Nature 466, 213-216 (2010).

[2] http://physics.nist.gov/cgi-bin/cuu/Value?rp|search_for=proton+radius

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