

The proton charge radius conundrum

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The 2010 measurement of the muonic hydrogen Lamb shift by Pohl and collaborators has questioned our understanding of hydrogenic systems. A significant disagreement with theoretical predictions, which can be interpreted as a discrepancy in the proton charge radius between electronic and muonic measurements has not been resolved till now. A single muonic measurement stands against dozens of electronic hydrogen and electron-proton scattering ones and no simple extension of the Standard Model can fix this. We will argue that the only solution which does not violate the lepton universality is the underestimated uncertainty of all the electronic measurements and it is the muonic hydrogen value which is the correct one. As a consequence this hypothesis will cause a significant changes in fundamental physical constants and I will present all possible means of verifying the new proton charge radius value.

Presenter: PACHUCKI, Krzysztof (Warsaw)