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The hadronic corrections to muonic hydrogen Lamb shift from ChPT and the proton radius

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We obtain a model independent expression for the muonic hydrogen Lamb shift. The leading hadronic effects are controlled by the chiral theory, which allows for their model independent determination. We give their complete expression including the pion and Delta particles. Out of this analysis and the experimental measurement of the muonic hydrogen Lamb shift we determine the electromagnetic proton radius: $r_p = 0.8412(15)$ fm. This number is at 6.8% variance with respect to the CODATA value. The parametric control of the uncertainties allows us to obtain a model independent determination of the error, which is dominated by hadronic effects.

Authors: PINEDA, Antonio (Universitat Autònoma de Barcelona /IFAE); PESET, Clara (Universitat Autònoma de Barcelona /IFAE)

Presenter: PESET, Clara (Universitat Autònoma de Barcelona /IFAE)

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