Nuclear Polarizability and the Lamb shift in Muonic Atoms

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Stimulated by the the proton radius conundrum [1] a measurement of the 2S-2P transition frequencies in $\mu^4\mathrm{He}^+$ and in $\mu^3\mathrm{He}^+$ are planned in PSI. The aim of these measurements is to determine the nuclear rms charge radius with relative accuracy of 3×10^{-4} limited by the uncertainty in the nuclear polarization contribution. In fact, to shed light on the radius puzzle the nuclear polarizability should be known with an accuracy better then 5% [2].

In order to achieve this accuracy, we present in this work the first *ab-initio* calculation of the nuclear polarizability contribution to the Lamb shift in $\mu^4\mathrm{He}^+$. We have used the EIHH [3] and the LIT [4] methods to obtain the ^{4}He response functions for the state of the art nuclear potential models, taking into account the leading multipoles and relativistic corrections. The systematic accuracy of our analysis is estimated to be comparable with the desired 5% goal.

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