

Progress towards Measuring the Lamb Shift of Muonium and Antihydrogen

G. Janka

Due to its lack of internal structure, Muonium is an excellent candidate to provide stringent tests for bound state QED. Furthermore, Muonium is a sensitive probe for the existence of exotic dark-sector particles, new muonic forces, and hidden dimensions. During the MuMass [1] beamtime in December 2019 at the LEM beamline at PSI, we demonstrated the creation of an intense directed beam of metastable Muonium. This opens up the possibility to measure the Muonium Lamb shift (LS) with an uncertainty of 100 kHz [2], improving the current determination by two orders of magnitude. The same LS setup will be used in the context of GBAR [3] at CERN to measure the antihydrogen Lamb shift with an uncertainty of 100 ppm, providing an accurate test of CPT [4]. The experimental setup, the current status and future plans will be presented.

- [1] P. Crivelli, "The Mu-MASS (muonium laser spectroscopy) experiment", *Hyperfine Interactions* 239, 49 (2018)
- [2] G. Janka et al., "Intense beam of metastable Muonium", arXiv:2004.02139, accepted by *Eur. Phys. J. C*
- [3] P. Pérez et al., "The GBAR antimatter gravity experiment," *Hyperfine Interactions* 233, 21–27 (2015)
- [4] P. Crivelli et al., "Antiproton charge radius", *Phys.Rev. D* 94 (2016) no.5, 052008 (2016)