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The FAMU experiment aiming to measure the ground stat hyperfine splitting of muonic hydrogen

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Should the recently reported results of the Muon g-2 Experiment at Fermilab (FNAL) on the muon magnetic anomaly be farther confirmed, strong potential indications of new physics would arise[1]. Precise calculations and measurements of this fundamental quantity provide a stringent test of the standard model. This scenario enhances the expectations from the experiments motivated, in recent years, by the notable results from muonic hydrogen laser spectroscopy which raised the attention on the values of the proton charge radius as measured with different methods[2]. The structure of atomic systems is described by quantum electrodynamics (QED) up to an extremely high precision allowing for high-precision experimental tests. The investigations of atomic systems go far beyond atomic physics. Our understanding of the different properties and processes in atoms provides access to an accurate determination of fundamental physical parameters, such as the Rydberg constant R_∞, the fine structure constant α, the lepton mass, the nuclear radii. Muonic atoms are about 200 times more sensitive to nuclear structure effects, the massive muon being closer to the proton. Muonic atoms spectroscopy has been exploring this context since many years (see for instance[3]. Next-generation experiments will provide innovative approaches to this task and farther extend the information obtainable from the muon proton interactions. The hyperfine splitting (hfs) in hydrogen represents a case where the accuracy of QED calculations exceeds those of the known values of fundamental physical parameters. It thus provides a unique possibility for the deduction of the low energy proton structure parameters via atomic physics measurements with higher accuracy than what can be achieved in nuclear or high-energy physics experiments. The hyperfine splitting is very sensitive to the charge and magnetization distributions of the nucleus. The FAMU experiment is involved in performing a precise laser spectroscopy measurement of the ground state hfs of the muonic hydrogen (μp)[4, 5]. From the measurement of the p 1S hfs precise information about the magnetic structure of the proton can be extracted. The status of the FAMU experiment will be presented.

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