



Contribution ID: 413

Type: Parallel talk

## The FAMU experiment at RIKEN RAL for a precise measure of the proton radius

Thursday, July 11, 2019 12:45 PM (15 minutes)

The FAMU (Fisica degli Atomi Muonici) experiment has the goal to measure precisely the proton Zemach radius, thus contributing to the solution of the so-called proton radius “puzzle”, consisting in a 6 sigma discrepancy between measurements with electrons and with muons of the charge proton radius. This discrepancy may point to new physics or violation of the lepton universality. To this aim, the FAMU experiment makes use of a high-intensity pulsed muon beam at RIKEN-RAL impinging on a cryogenic hydrogen target with an high-Z gas admixture and a tunable mid-IR high power laser, to measure the hyperfine (HFS) splitting of the 1S state of the muonic hydrogen. From the value of the exciting laser frequency, the energy of the HFS transition may be derived with high precision ( $\sim 10^{-5}$ ) and thus, via QED calculations, the Zemach radius of the proton. The experimental signature of the process will be the emission of characteristic X-rays ( $\sim 100$  keV) from the de-excitation of the high-Z muonic atoms formed when the muon is transferred from  $\mu p$  to  $\mu Z$ . Preliminary studies have provided indications on the most suitable high-Z elements to be used. The experimental apparatus includes a system of precise fiber-SiPM beam hodoscopes, a crown of eight 1”  $LaBr_3$  crystals read by photomultipliers complemented by additional 1/2”  $LaBr_3$  crystals read by SiPM arrays with temperature control and a few HPGe detectors for detection of the emitted characteristic X-rays around 100 keV. The system is in condition to detect the signal in a very noisy environment and has been used for preliminary runs. The experimental apparatus and the innovative method to determine the Zemach proton radius with high precision will be described in detail.

**Primary author:** ON BEHALF OF THYE FAMU COLLABORATION

**Presenters:** BONESINI, Maurizio; BONESINI, Maurizio (Universita & INFN, Milano-Bicocca (IT)); BONESINI, Maurizio

**Session Classification:** Detector R&D and Data Handling

**Track Classification:** Detector R&D and Data Handling