Contribution ID: **38** Type: **not specified**

Proton charge radius measurement

Monday, 17 August 2020 17:10 (15 minutes)

The proton is one of the essential bricks of matter, alongside with neutron; we know its mass, its charge but not its radius. Before 2010, the proton charge radius was thought to be known by physicists, measurements of the proton charge radius converged to a value of 0.8775±0.051 fm [1] using two different methods: electron scattering and hydrogen spectroscopy. However, in 2010 a German team measured a radius of 0.84087±0.0039 fm with a new experiment based on muonic hydrogen spectroscopy [2]. Since then, many experiments were conducted and obtained results consistent with one of the two previous values. Until now this discrepancy remains a mystery.

At ELPH (Research Center for Electron Photon science), we aim at measuring the proton charge radius using electron scattering. The proton charge radius can be deduced from the charge form factor of the proton obtained from the absolute cross-section measured in a very small 4-vector transferred-momentum range. By sending extremely low-momentum electrons (between 20 and 60 MeV/c) on a polyethylene target, we can realize extremely low transfer-momentum scattering and obtain the proton charge radius with great precision. To prepare the experiment, we simulated the experiment with Geant 4 and calculated the momentum dispersion and the momentum resolution of the spectrometer. These results confirmed that the characteristics of the spectrometer allow us to measure the proton charge radius with the required precision.

[1] CODATA 2010: https://physics.nist.gov/cuu/Constants/Preprints/lsa2010.pdf
[2] Pohl, R., Antognini, A., Nez, F. et al. The size of the proton. Nature 466, 213–216 (2010). https://doi.org/10.1038/nature09250

Field of your work

Experiental nuclear physics

Primary author: LEGRIS, Clement (Tohoku University, ELPH)

Presenter: LEGRIS, Clement (Tohoku University, ELPH)

Session Classification: Young Scientist Session 1