

High-precision Measurement of the Proton Radius with Active Target TPC

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One of today's most pressing questions in nuclear physics is the understanding of the so-called "proton radius puzzle". The puzzle originates from a striking discrepancy between the electric charge radius of the proton, extracted from the muonic hydrogen Lamb shift, compared to measurements based on electron-proton scattering experiments and atomic transition measurements in electronic hydrogen. Solving this problem requires experiments approaching the problem in new ways. To address this puzzle, we will perform a high-precision measurement of the differential ep-scattering cross section in the region of low momentum transfer in Mainz. To perform this experiment, a new-generation detector, consisting of a Hydrogen Time Projection Chamber (TPC) and Forward Tracking System will be constructed. The experimental setup will allow to measure the energy and angle of the recoil proton with unprecedented accuracy and with a completely new approach compared to other experiments. A test measurement with a TPC prototype was conducted at MAMI in August 2017, which served as a basis for the main experiment.

Primary author: Dr ADLARSON, Patrik (Johannes Gutenberg Universität-Mainz)

Presenter: Dr ADLARSON, Patrik (Johannes Gutenberg Universität-Mainz)

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