Precision Few-Body Experiments with Electron Beams

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High precision experiments are the most important tool to identify the limits of our current understanding of compound hadronic objects. Nearly all new high precision results reveal clear discrepancies which show the need for more experimental and theoretical work to update our established pictures. A well known example is the proton radius puzzle, where the high precision atomic measurement of the proton radius [1] is in clear discrepancy with the high precision measurement of the same quantity with electron scattering [2]. This discrepancy triggered a large experimental program, where precision few-body physics turned out to be a key ingredient for the understanding of the effect. Similar measurements on the deuteron in atomic physics e.g. to extract the neutron amplitudes are limited by the understanding of the few-body structure of the deuteron. In this talk, the program for precision few-body electron scattering experiments at Mainz will be presented. At the Mainz Microtron (MAMI) the spectrometer setup of the A1 Collaboration e.g. will aim at the form factor measurements and break-up channels of light hadronic systems. In addition, the planned new low energy, high current accelerator MESA will be design for high intensity experiments for e.g. Neutron Skin measurements and experiments for parity violation.

[1] R. Pohl *et al.*, Nature 466 (2010) 213.

[2] Jan C. Bernauer *et al.*, Phys. Rev. Lett. 105, 242001 (2010).

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