

Precision experiments at the MESA accelerator

Wednesday, 1 November 2023 09:00 (30 minutes)

The Mainz Energy-Recovery Superconducting Accelerator MESA, currently under construction at the Institute of Nuclear Physics at Mainz, provides the basis for precision experiments in the areas of nuclear, hadron, and particle physics. In this talk, we report on the comprehensive physics program of the three fixed-target experiments prepared for MESA: (i) MAGIX, (ii) P2, and (iii) DarkMESA.

MAGIX will make use of MESA's innovative energy recovery technique, which enables very high beam intensities. The setup is equipped with a gas jet target, surrounded by two high-resolution magnetic spectrometers. The combination of a high-intensity electron beam with such a window-less gas jet target is innovative and will allow for instance for determinations of the proton radius, searches for dark sector particles, and measurements of reactions of relevance for nuclear astrophysics.

The P2 experiment will be operated in the external beam mode of MESA and will measure the parity-violating spin asymmetry, which in turn yields a measurement of the electroweak mixing angle at low momentum transfer. The comparison of such a measurement with the Standard Model (SM) prediction will allow to test extensions of the SM at scales of up to 50 TeV. Furthermore, the neutron skin of nuclei can be extracted.

Finally, the DarkMESA beam dump experiment, located behind the beam dump of P2, will search for hypothetical light dark matter particles

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