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Measurement of the proton scalar polarizabilities at MAMI

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The electric ($\alpha E1$) and magnetic ($\beta M1$) scalar polarizabilities describe the response of the nucleon to an applied electric or magnetic field. They are not only fundamental properties related to the internal structure and dynamics of the nucleon, but they are important also in other areas of physics, such as atomic structure. The values of $\alpha E1$ and $\beta M1$ quoted by the Particle Data Group were determined using data on the unpolarized differential cross-section of the Compton scattering $\gamma p \rightarrow \gamma p$. The measurement of the beam asymmetry Σ_3 , provides an alternative approach to the extraction of the scalar polarizabilities, with different sensitivity and systematics compared to the unpolarized cross-section. This asymmetry was measured recently for the first time below the pion photoproduction threshold by the A2 Collaboration with the Crystal Ball/TAPS experiment at MAMI (Mainz, Germany).

A linearly polarized photon beam impinged on a liquid hydrogen target and the scattered photons were detected with the Crystal Ball/TAPS setup, providing almost 4π coverage.

A new high precision measurement of both unpolarized cross-section and beam asymmetry Σ_3 is ongoing at MAMI and the polarizabilities $\alpha E1$ and $\beta M1$ will be extracted with unprecedented precision. The impact of the recently obtained and expected results on the extraction of the scalar polarizabilities will be discussed.

*On the behalf of A2 Collaboration.

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