The VCS ("spin VCS") program at Mainz

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Virtual Compton Scattering from the proton, i.e. the process $p + \gamma* \rightarrow p + \gamma$, is a method to directly access generalized polarizabilities of the nucleon which are fundamental properties of the same quality as e.g. form factors and charge density distributions.

While theory gives straight forward recipies how to extract the polarizabilites from the cross section [1], the experiments are very challenging due to the overwhelming background of the Bethe-Heitler cross section.

Nevertheless, first data points on unpolarized cross sections are now available from MAMI [2] at $Q^2 = 0.33\,\mathrm{GeV/c^2}$ and from JLAB at higher Q^2. Data at an even lower value of Q^2 can be expected from the OOPS collaboration at MIT-Bates.

By unpolarized VCS without Rosenbluth separation it is possible to extract only two linear combinations of six independent generalized polarizabilities. To extract all polarizabilites polarization observables are neccessary.

In principle it is possible to access all polarizabilites by a single beam-recoil double polarization measurement with out of plane detection [3]. The feasibility of such an experiment was investigated at MAMI [4] and will be discussed in this talk.

For these investigations we used predictions from Chiral Perturbation Theory (ChPT) for the count rate estimates. Meanwhile, calculations on the basis of dispersion relations (DR) are available [5], which predict a much smaller effect for the polarization observables. On the other hand, the quality of these predictions, which depend strongly on the quality of the scarce pion production database in this Q^2 region, can be tested by a polarized beam experiment at the energy of the $\Delta(1232)$ resonance. In the framework for DR the sensitivity to the polarizabilities is largest at this energy.

A test experiment with polarized beam and out of plane acceptance was perform at MAMI. Besides the test of the DR prediction, it will be tried to extract via the DR formalism an improved value for the polarizabilities from the simultaneous cross section measurement.

References

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