Deeply-Virtual Compton Scattering at HERMES

F. Ellinghaus (for the HERMES Collaboration)
DESY, Germany

Inclusive and semi-inclusive deep-inelastic scattering (DIS) is and has been extensively used to study the internal structure of the nucleon. Recent theoretical progress is mostly related to exclusive reactions and their description in terms of generalized parton distributions (GPDs). This theoretical framework takes into account the dynamical correlations between partons of different momenta in the nucleon. The well-known parton distribution functions and form factors turn out to be the limiting cases and moments of GPDs. Of particular interest is the second moment of two unpolarized quark GPDs, which for the first time offers a possibility to determine the total angular momentum carried by the quark in the nucleon [1].

We report our latest observations of azimuthal asymmetries in the hard electroproduction of real photons with respect to the spin and the charge of the incoming lepton beam. The asymmetries are attributed to the interference between the Bethe-Heitler process and the deeply-virtual Compton scattering (DVCS) process, which gives access to the latter at the amplitude level. The DVCS process appears to be the theoretically cleanest way to access GPDs. The data have been accumulated by the HERMES experiment at DESY, scattering the HERA 27.6 GeV electron/positron beam off unpolarized gas targets.

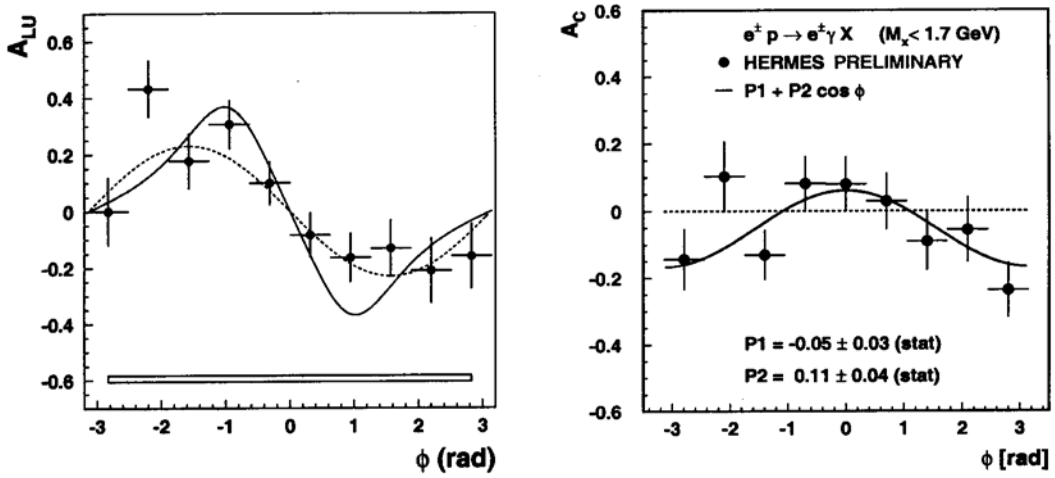

Figure 1: Beam–spin asymmetry A_{LU} [2] and beam–charge asymmetry A_C [3] for the hard electroproduction of photons as a function of the azimuthal angle ϕ. The data correspond to the missing mass region between -1.5 GeV and $+1.7$ GeV. The dashed curve represents a $\sin\phi$ dependence with an amplitude of 0.23, while the solid curve represents the result of a GPD model calculation [4]. The solid line in the right figure represents a $P_1 + P_2 \cos(\phi)$ fit to the data.

References

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[3] F. Ellinghaus [for the HERMES Collaboration], hep-ex/0207029.
[4] N. Kivel, M.V. Polyakov and M. Vanderhaeghen, Phys. Rev. **D 63** (2001) 114014.