Experimental verification of the GDH sum rule up to 3 GeV

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The Gerasimov-Drell-Hearn (GDH) sum rule [1] connects the integrated cross section difference $\sigma_{3/2} - \sigma_{1/2}$ for absorption of circularly polarised photons an longitudinally polarised nucleons with the static properties of the nucleons, in particular with their spin and their anomalous magnetic moment. Only recently, these double polarisation measurements became feasible. These experiments have been realised at the electron accelerator facilities MAMI in Mainz up to $E\gamma$=800 MeV and at ELSA in Bonn in the range 0.5–3 GeV.

The total cross section difference for the lower energy range has been published [2,3], also that for some partial reaction channels. It shows a clear signature of the Δ-resonance (Fig. 1). The interpretation of the yield around 700 MeV in terms of direct resonance excitation and/or 2π-production is still in progress. The running sum for the GDH integral

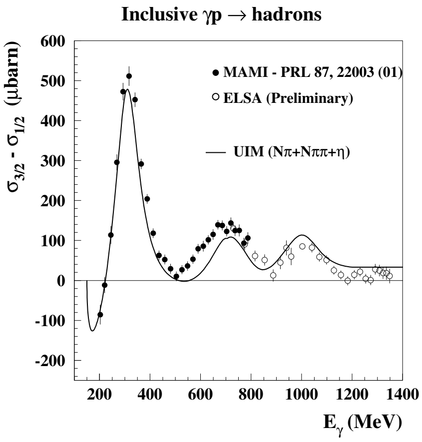

Figure 1: The cross section difference $\sigma_{3/2} - \sigma_{1/2}$ in the photon energy range from 200 MeV to 1.4 GeV in comparison with model predictions.

does not saturate at 1.4 MeV. The new “Bonn”-data exhibit several structures up to ≈1.6 GeV in the cross section difference, which then becomes flat, crosses zero and remains negative in the present energy range.

The degree of exhaustion of the GDH sum rule within the range of 3 GeV and that for spin polarisability γo will be discussed as well as the high energy extrapolation. Furthermore, we present the exploratory data on the deuteron.

References

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