

Abstract

High-statistics measurements of the photon asymmetry Σ for the $\gamma p \rightarrow \pi^0 p$ reaction have been made in the center-of-mass energy range $W = 1214\text{--}1450$ MeV. The data were measured with the MAMI A2 real photon beam and Crystal Ball/TAPS detector systems in Mainz, Germany. The results significantly improve the existing world data and are shown to be in good agreement with previous measurements, and with the MAID, SAID, and Bonn-Gatchina predictions. We have also combined the photon asymmetry results with recent cross-section measurements from Mainz to calculate the profile functions, $\Sigma^\vee (= \sigma_0 \Sigma)$, and perform a moment analysis. Comparison with calculations from the Bonn-Gatchina model shows that the precision of the data is good enough to further constrain the higher partial waves, and there is an indication of interference between the very small F-waves and the $N(1520)3/2^-$ and $N(1535)1/2^-$ resonances.