πNN COUPLING AND $\gamma N \to \pi\pi N$ REACTIONS

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Recently, experiments of two-pion photoproductions including neutral pions, i.e., $\gamma p \to \pi^+\pi^0 n$, $\gamma p \to \pi^0\pi^0 p$ and $\gamma n \to \pi^-\pi^0 p$ reactions, have been performed at MAINZ at photon energies ranging 0.4-0.8 GeV [1–3], where the N*(1520) resonance plays an important role. The purpose of these experiments was to study the reaction mechanism of the above reactions, since the comparison of the previous measurements with theories indicated that some important production mechanisms were missing. We examine the effect of nonresonant reaction mechanisms, particularly, background parts arising from πNN coupling that were so far considered to have only small contributions to the cross sections. It is well-known in the studies of single pion photoproduction that the PV πNN coupling is preferred at low energies but the PS πNN coupling leads to a better description at higher energies and different choices of the πNN coupling affect the neutral pion production significantly [4]. In our theoretical calculations of total cross sections for two-pion photoproductions with these different couplings, which are shown in Fig. 1, we find that the nonresonant production by the PS coupling contributes to the cross sections for the neutral pion production largely and the PS coupling is more favored than the PV coupling. The calculations in Fig. 1 include the resonant productions by N*(1520) and Δ(1232) in addition to the non-resonant contributions. We also see some differences between two πNN couplings in the calculations of invariant mass spectra and helicity cross sections by polarized photon and proton.

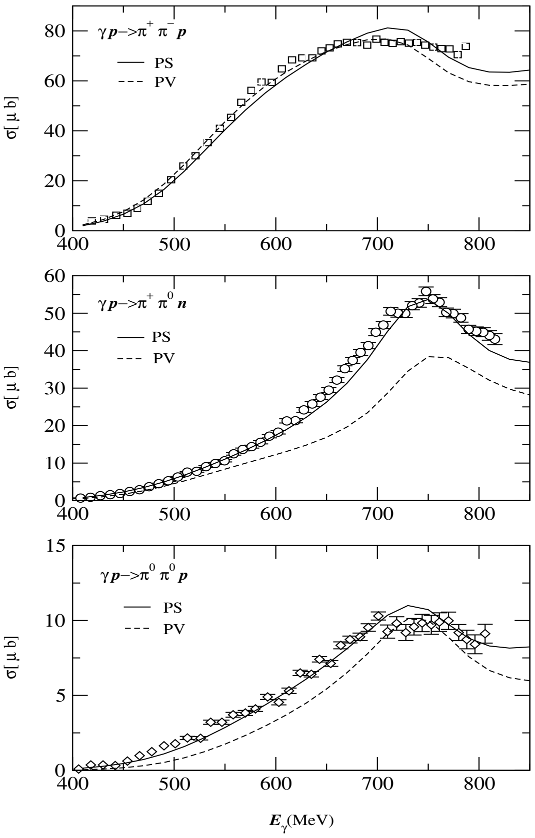

FIG. 1: Total cross sections of two-pion photoproduction on proton in various isospin channels. Data from refs. [5](squares),[1] (circles) and [2](diamonds).

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