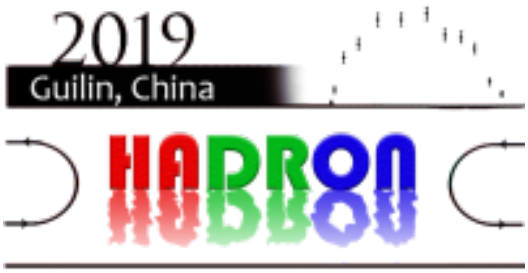


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# Photoproduction of the S-, P- and D-wave resonances on protons in the π+π- channel

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The study of resonance photoproduction is essential for both fundamental and practical reasons. On the one hand the structure of resonances is directly related to basic properties of QCD like the confinement. On the other hand reliable models are needed to describe the wealth of the resonance photoproduction data to be expected in near future from JLab, ELSA, MAMI, BESIII and SPring-8 experiments. Of many accessible photoproduction channels the $\pi^+\pi^-$ pair production is of particular interest as this is the only reaction where the photoproduction of scalar $f_0$ resonances has been observed so far. Moreover, this reaction provides unique opportunity to embed the well known hadronic amplitudes of $\pi p$ scattering into the amplitudes of electromagnetic process.

We simultaneously describe the photoproduction of resonances in several partial waves, namely S, P and D [1]. In our approach the photoproduction amplitude consists of two mechanisms. The long range mechanism (diffuse source) is dominated by one pion exchange related to the dynamical singularity which is nearest to the physical region. The short range mechanism (compact source) collectively includes contributions related to singularities located far away from the physical region. To describe the long rage mode we have combined the Deck model with SAID parametrisation of the $\pi p$ scattering amplitude. Such approach makes the description of the long range mode essentially parameter free. The short range mode, which includes eg. the exchange of heavier mesons and quark/gluon processes can be parameterized in terms of smooth functions. In this respect we have chosen the 1-st order polynomials in the $\pi\pi$ energy. The coefficients of these polynomials were then fitted to experimental mass distributions.

We found a very good agreement of $\pi^+\pi^-$ mass distributions for S, P and D partial waves with fits made by CLAS collaboration [2]. Our mass distributions are consistent with the fact that the S, P and D waves are dominated by resonances $f_0(980)$, $\rho(770)$ and $f_2(1270)$, respectively. We have also found that strengths of the short range components of the P and D waves are much larger than for the S wave. Thus the $\rho(770)$ and $f_2(1270)$ resonances are photoproduced from the compact source while the $f_0(980)$ from the diffuse source. This in turn is in accord with the expectation that $\rho(770)$ and $f_2(1270)$ are conventional $q\bar{q}$ states while the $f_0(980)$ is a more loosely bound four quark state.

References

1. Ł. Bibrzycki, P. Bydžovský, R. Kamiński, A.P. Szczepaniak, Phys.Lett. B789, 287-291 (2019)
2. M. Battaglieri, et al., CLAS collaboration Phys. Rev. D, 80, 072005 (2009)

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