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Exclusive production of $\pi^+\pi^-$ pairs in diffractive photon-proton and in proton-proton collisions within the tensor-pomeron approach

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We discuss the central exclusive photoproduction of $\pi^+\pi^-$ pairs in diffractive photon-proton and in proton-proton collisions at high energies. We consider the resonant ($\rho, \omega, f_2(1270)$) and non-resonant (Drell-S\"oding) contributions. Our calculation is based on the tensor-pomeron approach. We present a completely new calculation of the non-resonant term for the reaction $\gamma p \to \pi^+\pi^- p$. Our result is derived in the framework of Quantum Field Theory (QFT). We extend the calculation to virtual photons with $Q^2 < 1.5$ GeV^2. For the $pp \to pp\pi^+\pi^-$ reaction, we calculate differential cross sections as a function of the two-pion invariant mass. We discuss the important role of the Drell-S\"oding mechanism in shaping the resonance line. Our research is relevant in the context of ALICE, ATLAS, CMS, and LHCb measurements in proton-proton collisions at the LHC, even when the leading protons are not detected and instead only rapidity-gap conditions are checked experimentally. Our results can also serve as basis for the description of coherent dipion production in ultra-peripheral pA and AA collisions. This approach can be directly applied to the analysis of photoproduction and small-Q^2 electroproduction in ep collisions at high energies. Such data exist from the HERA experiments and will be obtained in the future at the electron-ion colliders.

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Collaboration

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