

Abstract

This dissertation discusses various photon-induced processes for the LHC and EIC energies. It discusses the processes of production of charged lepton pairs in two-photon exchange and the production of diffraction dijets in electron-proton collisions.

The former mechanism has been considered in the context of muon and electron production in proton-proton collisions and refers to experimental data, explaining the reasons for the occurrence of a small number of leptons in the region of small rapidities (close to 0.0) and large invariant masses (300 - 1000 GeV). As part of this analysis, as in the case of the proton-yield collisions included further in the paper, different photon structure functions in the proton were included, as part of which the Kulagin-Barinov model was compared to experimental data for the first time. On the other hand, the amplitude of the studied processes was formulated according to the transverse factorization approach with the help of wave functions of bound states on the light cone. The influence of rapidity gap survival effects was also taken into account in both cases making it possible to exclude the involvement of diffraction dilepton production mechanisms.

The discussion further included the processes of jets production in proton-nucleus and electron-proton collisions. As part of it, six models of the unintegrated parton distribution functions in the proton were compared, four of which were subjected to a double Fourier-Bessel transform in order to go into the transverse momentum space of the produced quarks. This procedure made it possible to highlight the imperfections of the models fitted to the data, and the need to take into account additional mechanisms to correctly reproduce the experiments carried out on the HERA collider. In addition, correlations in the azimuthal angle were analyzed, showing their origin to be associated with elliptical unintegrated gluon distributions in the proton as well, as superimposed kinematic cuts.

The posted conclusions are based on the analysis of experimental data and theoretical models and indicate the need for further in-depth study of hadron structure, especially in the context of processes involving pomeron exchange.