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$\gamma \rightarrow \rho^0$ impact factor in QCD: light-cone sum rule calculation

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We discuss the $\gamma \rightarrow \rho^0$ impact factor, i.e., the transition amplitude of a photon to a neutral vector meson ρ^0 , where the transition is mediated by the two t-channel gluons. The impact factor is a building block in the QCD descriptions of high-energy exclusive processes like $\gamma p \rightarrow Vp$, and $\gamma\gamma \rightarrow VV$, with $V = \rho^0, \omega, \phi, \dots$. In the framework of QCD factorization, the impact factor is expressed as a convolution of the partonic amplitude, $\gamma g \rightarrow q\bar{q}g$, in perturbation theory and the quark-antiquark light-cone distribution amplitudes for the vector meson V . The corresponding factorization formula has been successfully derived for the case of the longitudinal polarization of V . For the transverse polarization of V , however, the corresponding formula is associated with the higher twist (twist-three) contributions and the factorization is known to break down due to infrared divergences which manifest themselves as endpoint singularities arising in the convolution integral. This fact indicates that the impact factor for the transversely polarized vector meson is dominated by the non-factorizable "soft" contributions. We study the $\gamma \rightarrow \rho^0$ impact factor constructing the light-cone QCD sum rules for the corresponding amplitudes, which allow us to estimate the relevant soft contributions in a largely model-independent way, with the use of dispersion relations and quark-hadron duality. We are able to obtain the finite result for the impact factor with the transversely polarized ρ^0 meson, ρ_T^0 , as well as for ρ_L^0 with the longitudinal polarization. We compare our results with the approach based on the vector meson dominance model associated with the pomeron exchange. As an application, we calculate the cross sections for $\rho^0\rho^0$ production in two-photon collisions, in particular, the cross sections for $\gamma\gamma \rightarrow \rho_L^0\rho_T^0$ with the different polarizations in the forward productions of the ρ^0 mesons, which may be measured in Belle II experiment.

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