# Diffraction at HERA

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## 1 Factorization in diffraction

The QCD properties of diffraction can be studied at HERA via diffractive positron proton interactions of type $e^+p \to e^+XY$. There hadronic diffractive system X is separated by large rapidity gap (due to colour singlet exchange) from the system Y which consists of a proton or a low mass system.The QCD collinear factorization implies that diffractive processes in deep inelastic scattering (DDIS) can be understood as a convolution of the process dependent perturbatively calculable matrix elements with universal diffractive parton density functions (DPDF), which gather the nonperturbative components of diffractive process[1]. These are determined from NLO QCD fits to measurements of inclusive diffractive DIS cross sections within the factorizable Pomeron model and using DGLAP evolution equations [2]. If QCD factorization is fulfilled, NLO QCD calculation based on these DPDFs should be able to predict the production rates of exclusive diffractive processes like dijet and open charm production. It has been found that in the regime of DIS the predictions of QCD are in good agreement with the experimental results [3, 4, 5, 6]. In the regime of photoproduction the cross section for dijet production was however found to be suppressed by factor about 1.6 in comparison with NLO QCD predictions thus indicating QCD factorization breaking in photoproduction [7, 8]. On the contrary there is not observed the evidence for such a suppression (within large theoretical and experimental errrors) in open charm photoproduction [5, 9].

## 2 Vector meson production

From the measurement of the W dependence of the exclusive $\rho^0$ photoproduction the Pomeron trajectory $\alpha_P(t)$ has been extracted. The value $\alpha'$ was found to be smaller than the value 0.25 $GeV^2$ [10]. The cross section for elastic J/$\psi$ in photoproduction was measured [11]. Within models, the data show a high sensitivity to the gluon density of the proton in the low x and low $Q^2$ region.

The diffractive photoproduction of $\rho^0$ [12] and J/$\psi$ [13, 14] with large momentum squared at the proton vertex, $|t|$, has been investigated. The data of diffractive photoproduction of $\rho^0$ indicate a violation of s-channel helicity conservation[12], on the contrary J/$\psi$ production data were found to be compatible with helicity conservation [14]. Data were compared to the predictions of QCD perturbative models.

## References


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