Diffractive Photon and Vector Meson Production at Large $|t|$ at HERA.

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Measurements of exclusive diffractive processes at HERA are presented in which the magnitude of the four-momentum transfer squared $|t|$ at the proton vertex is large. Due to the experimentally clean signatures and small backgrounds such processes have been proposed as ideal testing grounds to search for the effects of BFKL evolution.

In perturbative QCD (pQCD) diffractive interactions can be modelled in the proton rest frame in which the incoming photon is assumed to fluctuate into a quark-antiquark pair before interacting with the proton. The interaction of the pair with the proton is via the exchange of a colour-singlet system. A large $|t|$ is expected to make it possible to perform a perturbative calculation and the detailed internal dynamical structure of the system can be studied.

The measured cross section for the diffractive photoproduction of high p_t photons is presented using data collected by the H1 experiment at HERA. The results are compared with pQCD expectations. In this process the theoretical uncertainties associated with the meson wavefunction (which is not completely calculable in perturbative QCD) are avoided. The cross section is investigated differentially as a function of $|t|$ and as a function of $x_{I\!P} \sim p_t^2/W_{\gamma p}^2$. A steep rise of the differential cross section $d\sigma/dx_{I\!P}$ towards small values of $x_{I\!P}$ is observed.

Measurements of diffractive vector meson production processes at large $|t|$ (in which a meson takes the place of the diffracted high p_t photon) are also presented using data collected by the H1 and ZEUS experiments at HERA. Proton dissociative photoproduction measurements for the diffractive production of the ρ and ϕ mesons are presented as a function of $|t|$. The dependence at large $|t|$ is approximately power-like $|t|^{-n}$ with an exponent $n \sim 3$ for both the ρ and the ϕ.

The total cross section for the diffractive photoproduction of the heavier J/ψ meson is presented as a function of the interaction energy $W_{\gamma p}$ in three $|t|$ intervals and the differential cross section $d\sigma/d|t|$ is presented as a function of $|t|$ extending out into the region of very large momentum transfer $|t| > M_{J/\psi}^2$. Recent J/ψ measurements which extend to higher values of $W_{\gamma p}$ are also presented as a function of $|t|$. The results are compared to pQCD predictions based on BFKL and DGLAP evolution. The behaviour of the effective pomeron trajectory is extracted and is consistent with no shrinkage.

Measurements of the helicity structure in high $|t|$ diffractive vector meson interactions are also presented. These are used to test assumptions for the meson wavefunction. The J/ψ measurements are compatible with assumptions of s-channel helicity conservation (in which the J/ψ retains the helicity of the incoming photon), in contrast to the ρ which shows significant variations from this behaviour.