

Exclusive photoproduction of ρ' states at HERA



Sergey Levonian¹, Arthur Bolz²

¹DESY, Hamburg,
²Universität Heidelberg



HERA storage ring (1992-2007)

- located at DESY, Hamburg
- electron-proton collisions
- centre-of-mass energy: $\sqrt{s} = 225 - 320$ GeV

H1 experiment

- central tracking system
- liquid-argon calorimeter
- muon chambers
- forward detectors

Exclusive vector meson photoproduction at HERA

Event display:
 $\psi' \rightarrow \pi^+ \pi^- \mu^+ \mu^-$

Event selection empty detector, only vector meson decay products are reconstructed.

Vector meson photoproduction world data

- ground-state (s-wave) vector mesons are well measured at HERA: $\rho, \omega, \phi, J/\psi, \Upsilon$
- At HERA energies, data well described by power-law $\sigma \sim W_{\gamma p}^\delta$ with mass-dependent exponent δ

Modelling

- predictions are often based on colour-dipole models and depend on the vector meson wave-function
- models can be tested by measuring excited states such as ψ' and ρ'
- example: ratio ψ'/ψ cross-section as a function of the photon virtuality Q^2

This analysis: excited ρ states $\rho(1450)$ and $\rho(1700)$. Decay channels: $2\pi^+2\pi^-$ and $\pi^+\pi^-$ are measured

Exclusive $\pi^+\pi^-$ photoproduction

- dominated by $\rho(770)$
- fit of lineshape using relativistic Breit-Wigner for vector mesons plus background
- amplitudes added taking into account complex phases

Result for excited ρ states:

- clear evidence for $\rho(1700)$
- width and mass agree with PDG
- no evidence for $\rho(1450)$

Exclusive $2\pi^+2\pi^-$ photoproduction

- $Q^2 < 2$ GeV, $|t| < 1$ GeV², $M_Y < 1.6$ GeV
- HE run ($\sqrt{s} = 320$ GeV): $45 < W_{\gamma p} < 100$ GeV
- LE run ($\sqrt{s} = 225$ GeV): $35 < W_{\gamma p} < 75$ GeV

Decay analysis

transverse momentum of the 4 tracks
non-resonant background amounts to about 15%

Cross-sections as a function of $W_{\gamma p}$

- extended kinematic range of previous measurements
- Regge-like behaviour

invariant mass can be described by single Breit-Wigner plus background (near 1600 MeV)
further investigations needed to disentangle $\rho(1450)$ and $\rho(1700)$