Diffractive η_c production by weak neutral current

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Hard diffractive processes in QCD have attracted much interest in the last decade. In particular, the diffractive leptoproduction of neutral vector mesons $\gamma^{(*)} + p \rightarrow V + p$, provides unique opportunities to access the gluon dynamics at small-x kinematics. In those processes, since photon virtuality Q^2 and/or heavy quark mass set the hard scale, we can use the QCD factorization to calculate the production amplitudes[1].

In this talk, we concentrate on the diffractive production of heavy pseudoscalar mesons, η_c and η_b, off a nucleon via the weak neutral current by the neutrino $\nu + p \rightarrow \nu + \eta_Q + p$ $(Q = c, b)$[2]. This is the first theoretical study based on QCD to calculate the neutrino induced diffractive processes. We adopt the color-dipole picture which has been successfully applied to the various diffractive processes[1,3]. The wave function of Z_0 boson is newly evaluated within the light-cone perturbation theory. The light-cone wave function of η_Q is also constructed with the help of the non-relativistic potential model.

We find that the amplitude mediated by the transversely polarized Z_0 boson vanishes, and only the longitudinal component contributes to the production process of η_Q. The η_c production cross section which originates from the axial-vector component of the weak current is about 50 times as large as the J/ψ cross section provided by its vector component. This is because the overlap integral of the Z_0 and η_c wave functions is quite different from that of J/ψ. The production cross section in Figs.1 and 2 would be accessible at future neutrino facilities. We also consider the production of the bottomed pseudoscalar meson η_b.

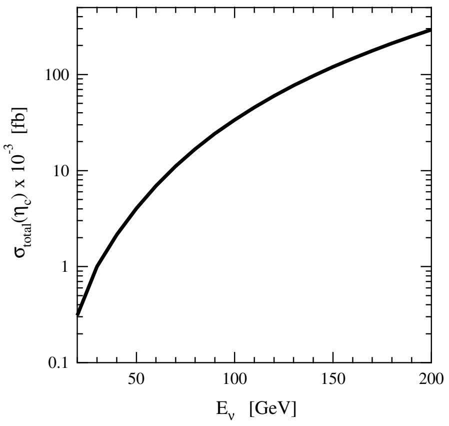

Figure 1: Total cross section

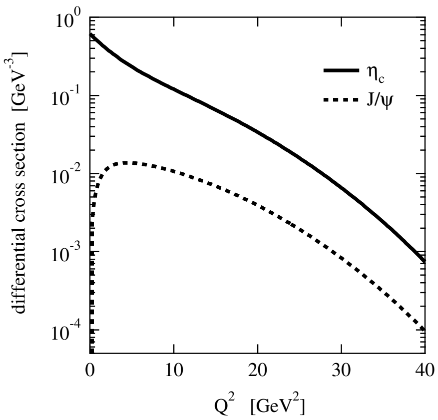

Figure 2: Q^2 dependence

References

[1] S.J. Brodsky etal., Phys. Rev. **D50** (1994) 3134; K. Suzuki etal., Phys. Rev. **D62** (2000) 031501(R), and references therein.
[2] A. Hayashigaki, T. Hatsuda, H. Mineo, K. Suzuki, K. Tanaka, preprint (2002)
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