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by

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QCD CORRECTIONS TO NEUTRINO CHARM PRODUCTION ⁺

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We summarize some results of the $O(\alpha_s)$ chromodynamic corrections to neutrino production of heavy quarks. The treatment is necessarily quite brief; all details are deferred to Ref.1.

The basic output of the perturbative calculation itself is the set of kernels K_j^q, K_j^g relating the charm production structure functions F_j to quark and gluon densities measured in electroproduction, e.g.:

$$F_2(x) = 2x \left\{ \hat{q}(x) + \int_x^1 \frac{dz}{z} K_2^q(\lambda, z) \hat{q}(x/z) + \int_x^1 \frac{dz}{z} K_2^g(\lambda, z) G(x/z) \right\} \quad (1)$$

where $\lambda \equiv Q^2/(Q^2 + M^2)$. The kernels are given by differences in parton-level terms

$$K_j^q(\lambda, z) \equiv H_j(W^*q + cX) - H_j(\gamma^*q + qX) \quad (2)$$

Fig.(1) Fractional corrections to the charm production structure function F_2 .

The cancellation of perturbative singularities in Eq.(2)--mandated by factorization--requires a slow rescaling parton model. (This means, for example, that presently observed dimuon rates do not conclusively demonstrate suppression of the strange sea.) Uncertainties in the kernels arise from (i) choice of subtraction scale and (ii) treatment of the charmed sea.

Fig.(1) gives the ratio of corrected to lowest order results for $F_2(\nu N + \mu cX)$. The region $x' \leq 0.3$ is somewhat sensitive to subtraction scheme ambiguities. The divergences for $x' \rightarrow 1$ can be traced to $\ln(P/E)$ phase space factors and thus should be softened by summing higher orders. For $\lambda \rightarrow 1$, the corrections vanish, as required by the subtraction scheme in Eq.(2).

In Fig.(2) we show fractional corrections to the total charm production rates $R_c \equiv \sigma_{\text{charm}}/\sigma_{\text{Total}}$. The different curves are for (i) full perturbative subtraction and

Fig.(2) Fractional corrections to the total chara production rates R_C .

Fig.(3) Chara contributions to the longitudinal structure function F_L .

(II) no $\gamma^*G \rightarrow c\bar{c}$ subtraction (i.e., assuming no intrinsic charmed sea). In both cases, the corrections to R_C are modest. The small differences between I,II are significant in another regard: the smallness of $\gamma^*G \rightarrow c\bar{c}$ suggests that fusion model calculations based on $W^*G \rightarrow c\bar{c}$ are dominated by $\ln(Q^2/m_s^2)$ mass singularities, and thus probably are not perturbatively reliable.

Finally, Fig.(3) shows charm contributions to the longitudinal structure function F_L for inclusive νN scattering. The dotted curve in Fig.(3) is the total F_L/F_2 signal expected for four massless quarks. Except for very large Q^2 , charm provides a substantial fraction of the total F_L signal. Such effects must be taken into consideration in present experimental attempts to measure F_L/F_2 .

REFERENCE

T. Gottschalk ANL-HEP-PR-80-35 (1980) and references therein.