

Lepton-hadron Collider

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Project 3

1. Use CalcHEP or MadGraph to calculate the total cross section of DIS process

$$\nu_{\mu} + P \rightarrow \mu^{-} + X, \quad (1)$$

where the energy of ν_{μ} is 100 GeV, and the proton is at rest. (You only need to consider $u, d, s, \bar{u}, \bar{d}, \bar{s}$ quarks inside proton.)

2. Repeat the above calculation for

$$\bar{\nu}_{\mu} + P \rightarrow \mu^{+} + X, \quad (2)$$

and compare their cross sections. Again, $E_{\nu_{\mu}} = 100$ GeV.

3. If the target is a neutron (at rest), we can invoke

(flavor) isospin symmetry

$$u^P = d^N \quad \text{and} \quad d^P = u^N. \quad (3)$$

Compare $\sigma(\bar{\nu}_\mu P \rightarrow \mu^+ X)$ with $\sigma(\nu_\mu N \rightarrow \mu^- X)$.

4. Try to explain all the above results qualitatively using the quark parton model.