

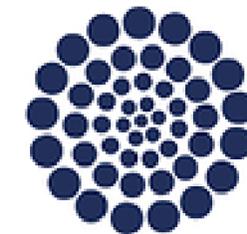
SOFT PION THEOREM

FOR PARTON DISTRIBUTIONS

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The motivation of the work is to explore the relationships between hadronic matrix elements with pions in final and initial states, studying the limits of the function.

$$\langle \pi^k(q) \beta | O(0) | \alpha \rangle = i \int d^4x e^{iq \cdot x} (\square + m_\pi^2) \langle \beta | T \{ \pi^k(x) O(0) \} | \alpha \rangle$$

**Matrix
Element**

[Donoghue et al.
Cambridge University
Press.]

LSZ Reduction Formula **+** $\pi^k = \frac{1}{F_\pi m_\pi^2} \partial^\mu A_\mu^k$ $Q_5^k = \int d^3x A_0^k(x)$

$$\lim_{q^\mu \rightarrow 0} \langle \pi^k(q) \beta | O(0) | \alpha \rangle = -\frac{i}{F_\pi} \langle \beta | [Q_5^k(x), O(0)] | \alpha \rangle$$

For parton distribution we change :

$$\begin{cases} O(0) \rightarrow O(x, 0) \\ \langle \pi_1 \pi_2 | O | 0 \rangle \rightarrow \langle \pi_1 | \pi_2 O' | 0 \rangle \end{cases}$$

$$\lim_{p_2 \rightarrow 0} \langle \pi^a(p_1) \pi^b(p_2) | \bar{\psi}(x) \hat{n} \frac{\tau^3}{2} \psi(0) | 0 \rangle = \frac{i \epsilon^{3bc}}{f_\pi} \langle \pi^a(P) | \bar{\psi}(x) \hat{n} \frac{\tau^c}{2} \psi(0) | 0 \rangle$$

[Polyakov. Nucl. Phys. B, 555:231.]