Finite mass sum rules for single and double diffraction dissociation

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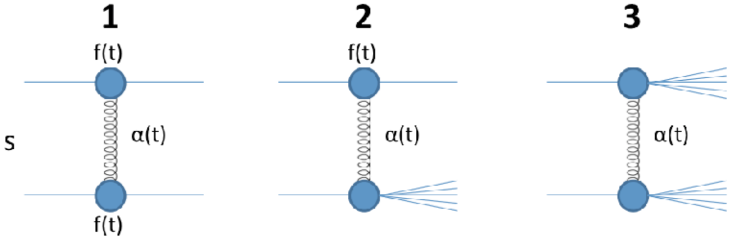
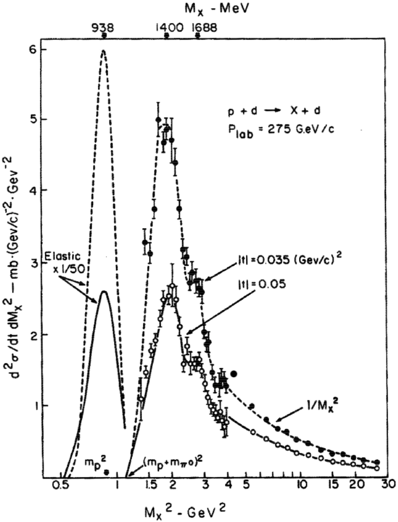
Diagrams



1. Elastic scattering
2. Single diffraction dissociation
3. Double diffraction dissociation

Compilation of low-mass SD data form Fermilab experiments



High-mass DD

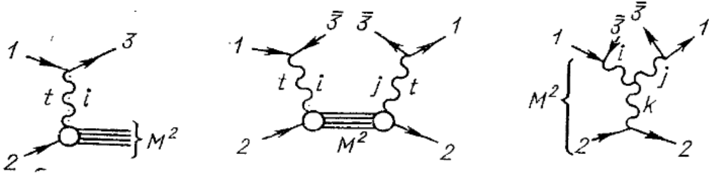


Figure: From SD to the triple Regge limit.

The double diffraction cross section for SD

$$\frac{d^2\sigma}{dt dM_x^2} = \frac{G_{13,2}^{\mathbb{P}\mathbb{P},\mathbb{P}(t)}}{16\pi^2 s_0^2} \left(\frac{s}{s_0}\right)^{2\alpha_{\mathbb{P}}(t)-2} \left(\frac{M^2}{s_0}\right)^{\alpha_{\mathbb{P}}(0)-\alpha_{\mathbb{P}}(t)} . \qquad (1)$$

References

- L. L. Jenkovszky, O. E. Kuprash, J. W. Lamsa, V. K. Magas and // R. Orava, Phys. Rev. D83 (2011) 056014, arXiv:1011.0664 [hep-ph].
- R. Fiore, A. Flachi, L.L. Jenkovszky, A.I. Lengyel, and V.K. Magas, Phys. Rev. D 69 (2004) 014004, hep- ph/0308178.
- L. Jenkovszky, O. Shchur, M. Anosova, in preparation.

Model

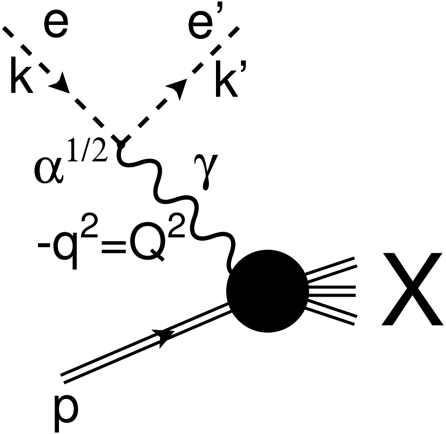


Figure: Virtual photon+proton → M_X transition.

Model

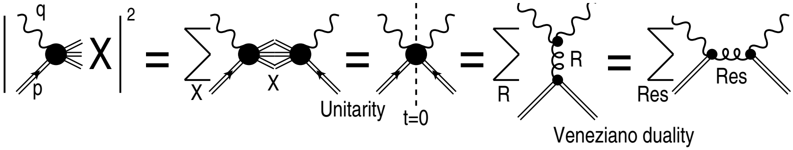


Figure: Connection, through unitarity (generalized optical theorem) and Veneziano-duality, between the inelastic form factor and the sum of direct-channel resonances.

Model

The virtual photon-proton scattering total cross section

$$\sigma_t^{\gamma^* p}(s) = \mathrm{Im}\, A(s, Q^2), \tag{2}$$

where scattering amplitude

$$[A(s, Q^2)]_{t=0} = N\Big(\sum_{r,n} \frac{f_r^{2(n-n_r^{min}+1)}(Q^2)}{n-\alpha_r(s)} + [A(s, Q^2)]_{t=0}^{BG}\Big). \tag{3}$$

Model

The non-linear trajectory can be written as:

$$\alpha(s) = \alpha_0 + \alpha_1(s) + \alpha_2(\sqrt{s_0} - \sqrt{s_0 - s}). \quad (4)$$

The threshold mass energy $s_0 = (m_\pi + m_p)^2 = 1.14\ GeV^2$.
The form factor $f(t)$ reads

$$f(t) = (1 - t/t_0)^{-2}, \quad (5)$$

where $t_0 = 0.71\ GeV^2$.

Model

$$[A(s,Q^2)]_{t=0}^{BG} = \sum_{b=E,E'} G_b \frac{c^4(Q_b)}{n_b - \alpha_b(s)} \tag{6}$$

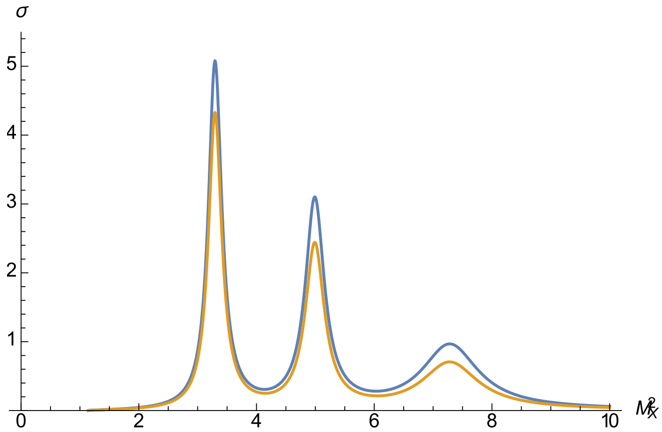
with dipole form factors, given by

$$c^2(Q_b) = \frac{Q_b^2}{Q^2 + Q_b^2}. \tag{7}$$

The exotic trajectories are chosen in the form

$$\alpha_b(s) = \alpha_b(0) + \alpha_{1b}(\sqrt{s_0} - \sqrt{s_0 - s}). \tag{8}$$

Cross sections for $t = -0.035\ GeV^2$ and $t = -0.05\ GeV^2$



Cross section for $t = -0.035\ GeV^2$