Production amplitude for the $pp \to pp\eta'$ reaction

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The cross section for the reaction $pp \to pp\eta'$ can be expressed as:

$$\sigma_{pp\to pp\eta'} = \frac{\int phase\ space \cdot |M_{pp\to pp\eta'}|^2}{flux\ factor} \quad (1)$$

where $M_{pp\to pp\eta'}$ denotes the transition matrix element for the $pp \to pp\eta'$ reaction. In analogy with the *Watson-Migdal* approximation [1] for two body processes, it can be assumed that the complete transition amplitude of a production process $M_{pp\to pp\eta'}$ factorizes approximately as [2]:

$$M_{pp\to pp\eta'} \approx M_0 \cdot M_{FSI} \quad (2)$$

where, M_0 accounts for all possible production processes, and M_{FSI} describes the elastic interaction of protons and η' meson in the exit channel. Assuming that the primary production amplitude does not change with the excess energy, and that only the proton-proton interaction is present in the exit channel the M_0 was calculated estimating the proton-proton interaction according to the Cini-Fubini-Stanghellini formula as described in reference [3].

Figure 1 compares the extracted absolute values for the modulus of amplitudes for the near to threshold production of the π^0 (triangles), η (circles) and η' (squares) mesons. It can be seen that $|M_0|$ stays nearly constant with the tendency of larger values at small Q for the η meson. Whereas very close to threshold it decreases for the pion production with the similar tendency for the η'

The behaviour of the extracted $|M_0|$ can be attributed to the attractive interaction of the proton-η and repulsive interaction of the proton-pion and proton-η' or to the actual variation of the primary production amplitude very close to the reaction threshold.

The large difference between the absolute values of the obtained modulus of the production amplitude for η and η' mesons, may suggests that the production mechanisms for these mesons are different. And since it is known that the η is produced via the excitation of the baryonic resonance, thus probably it is not the case for the η' production.

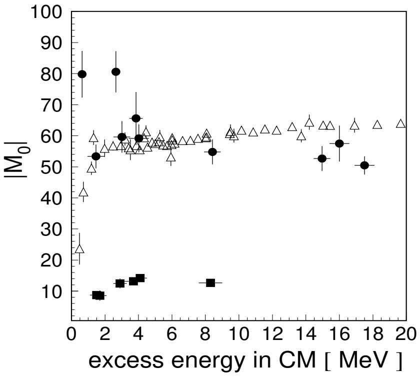

Figure 1: Symbols show the results extracted from the exprimental data for the reactions $pp \to pp\pi^0$ (open triangles) [4], $pp \to pp\eta$ (filled circles) [5, 6], and $pp \to pp\eta'$ (filled squares) [5, 7].

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