Charge Exchange Reaction in the $\Delta(1232)$ Excitation Region

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The double differential cross section for the inclusive (a,b) reaction can be written as [1]

$$\left(\frac{d^2\sigma}{dE_b d\Omega_b}\right)_r = \mathcal{A}\frac{m_a m_b k_b}{(2\pi)^2 k_a} < |\Gamma_{\pi ab}(q^2)|^2 > |G_\pi(q^2)|^2 \frac{|\mathbf{q}|}{\pi}\sigma_r(w) \equiv K\sigma_r(w). \qquad (1)$$

This equation describes all inelastic and absorptive processes induced by the virtual pion emitting from the projectile. Writing $\sigma_r(w)$ in terms of total and elastic scattering cross sections, i.e., $\sigma_r(w) = \sigma_t(w) - \sigma_{el}(w)$, the above equation can be split into two parts as

$$\left(\frac{d^2\sigma}{dE_b d\Omega_b}\right)_{inc} = K\sigma_t(w) \quad \text{and} \quad \left(\frac{d^2\sigma}{dE_b d\Omega_b}\right)_{coh} = K\sigma_{el}(w). \qquad (2)$$

$\sigma_t(w)$ includes the contributions from all channels in the virtual pion induced reaction. Therefore, the expression containing $\sigma_t(w)$ would pertain to be the cross section for the inclusive (a,b) reaction. The expression, which contains $\sigma_{el}(w)$, can be thought of describing the elastic scattering of virtual pion, and hence, this would represent the coherent pion emission in (a,b) reaction. Since the four-momentum distribution for the virtual pion is similar to that of the real pion [1], $\sigma_t(w)$ & $\sigma_{el}(w)$ have been approximated by the corresponding measured values for the real pion [2]. The calculated results along with the measured spectra for the $(^3\mathrm{He},t)$ reaction on $^{12}\mathrm{C}$ are shown below.

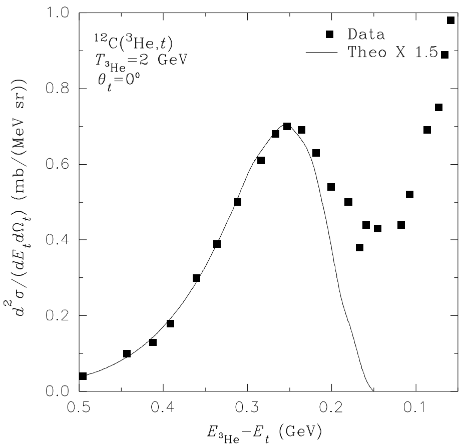

Fig. 1: Delta excitation in ^{12}C.

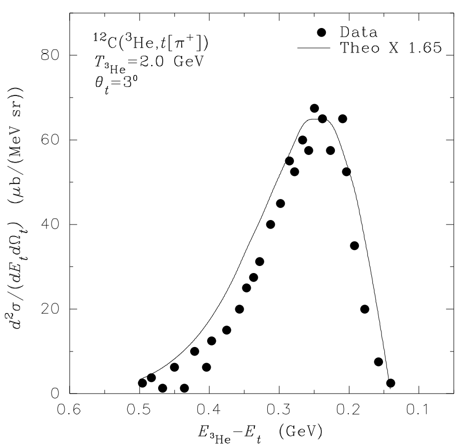

Fig. 2: Coherent Pion Production from ^{12}C.

References

[1] B.K. Jain and Swapan Das, Phys. Lett. B **386** (1996) 33. [2] A.S. Clough et al., Nucl. Phys. B **76** (1974) 15; A.S. Carroll et al., Phys Rev. C **14** (1976) 635; D. Ashery et al., Phys Rev. C **23** (1981) 2173.