Title
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We point out that formulas given by Pal on np and p$p^-$ CEX for exchange-degenerate and broken exchange-degenerate Regge pole models can be better rationalized by considering $\pi$ as simultaneously an $M = 0$ singlet and an $M = 1$ parity doublet and satisfying threshold behavior.

We have seen that np and p$p^-$ CEX (charge-exchange) and charged-pion photoproduction differential cross section produce sharp forward peaks. The pion conspiracy was popular and attractively economical in fitting those processes, it certainly is not unique, and it causes difficulties in other processes via factorization. We want to show here that the factorization difficulties resulting from the conspiracy hypothesis can be avoided if we take into consideration the pion as an $M = 0$ singlet and an $M = 1$ parity doublet simultaneously. The $M = 0$ pion is an evasive one with the usual pion-nucleon coupling constant at the pion pole, and an $M = 1$ is a parity doublet satisfying the conspiracy relation. An $M = 0$ pion singlet and an $M = 1$ parity doublet were considered.
simultaneously in np CEX. Only an $M = 1$ pion parity doublet was considered by Pal in the np and pp CEX broken exchange-degenerate Regge pole model. Now an $M = 0$ evasive pion should occur in invariant amplitudes $G_i(s, t, u)_{t=0, 1}$ in the following manner:

$$G(s, t, u)_{T=0, 1} = G_2(s, t, w)_{T=0, 1} = G_5(s, t, w)_{T=0, 1}$$

$$= -\frac{g^2}{\pi} \alpha'(t) \Gamma[-\alpha(t)] (1 + e^{-i\pi\alpha(t)}) \left(-\frac{3}{2}, \frac{1}{2}, \frac{s}{s_0}\right)\alpha(t),$$

$$G_3(s, t, u)_{T=0, 1} = G_4(s, t, u)_{T=0, 1}$$

$$= \frac{g^2}{\pi} \alpha'(t) \Gamma[-\alpha(t)] (1 + e^{-i\pi\alpha(t)}) \left(-\frac{3}{2}, \frac{1}{2}, \frac{s}{s_0}\right)\alpha(t)$$

for the pion exchange in the $t$ channel, and therefore,

$$\phi_2(s, t)_{T=0, 1} = \phi_4(s, t)_{T=0, 1}$$

$$= -\frac{t}{2\sqrt{s}} \frac{g^2}{\pi} \alpha'(t) \Gamma[-\alpha(t)] (1 + e^{-i\pi\alpha(t)}) \left(-\frac{3}{2}, \frac{1}{2}, \frac{s}{s_0}\right)\alpha(t)$$

and all other $\phi_i(s, t)$ are zero. For the pion exchange in the $u$-channel,

$$G_1(s, u, t)_{T=0, 1} = G_4(s, u, t)_{T=0, 1} = G_5(s, u, t)_{T=0, 1}$$

$$= -\frac{g^2}{\pi} \alpha'(u) \Gamma[-\alpha(u)] (1 + e^{-i\pi\alpha(u)}) \left(\frac{3}{2}, \frac{1}{2}, \frac{s}{s_0}\right)\alpha(u)$$
\[ G_2(s, u, t)_{T=0, 1} = G_3(s, u, t)_{T=0, 1} \]
\[ \frac{g^2}{\pi} \alpha'(u) \Gamma[-\alpha(u)] \left( 1 + e^{-i\pi \alpha(u)} \right) \left( \frac{s}{s_0} \right) \alpha(u) \left( \frac{3}{2}, \frac{1}{2} \right), \] (4)

and therefore

\[ \phi_2(s, u)_{T=0, 1} = -\frac{u}{2\sqrt{s}} \frac{g^2}{\pi} \alpha'(u) \Gamma[-\alpha(u)] \left( 1 + e^{-i\pi \alpha(u)} \right) \left( \frac{s}{s_0} \right) \alpha(u) \left( \frac{3}{2}, \frac{1}{2} \right), \] (5)

and all other \( \phi_i(s, u) \) are zero.

In Ref. 5, the residues were not properly rationalized, and therefore they did not satisfy correct threshold behavior for \( \phi_5(s, t, u) \) only.

Choosing the same invariant amplitudes in Ref. 5 for the t-channel pion exchange, one has conspiracy \( \pi_c \) and its exchange degenerate \( B_c \)

\[ \phi_5(s, t)_{T=0, 1} \]

\[ \frac{\text{large } s}{\text{fixed } t} \sim -\left( -\frac{3}{2}, \frac{1}{2} \right) \beta_t \left( 1 \right)^{1/2} \left( s + t - 4m^2 \right)^{1/2} \frac{(bs) \alpha(t) - 1}{m} \frac{\alpha(0) \Gamma[\alpha(t)] \sin \pi \alpha(t)}{\sin \pi \alpha(t) \alpha(0) \Gamma[\alpha(t)] \sin \pi \alpha(t)} \] (6)

instead of

\[ \phi_5(s, t)_{T=0, 1} \]

\[ \frac{\text{large } s}{\text{fixed } t} \sim -\left( -\frac{3}{2}, \frac{1}{2} \right) \beta_t \left( 1 \right)^{1/2} \left( 1 + \frac{s}{m^2} \right)^{1/2} \frac{m(bs) \alpha(t) - 1}{\sin \pi \alpha(t) \alpha(0) \Gamma[\alpha(t)] \sin \pi \alpha(t) \alpha(0) \Gamma[\alpha(t)]} \]
In Ref. 5, it does not satisfy correct threshold behavior\(^7\) \(\alpha(-t)^{1/2}\) for small \(t\). For the \(u\)-channel pion exchange, one has

\[
\phi_5(s, u)_{T=0, 1} \text{ large } s \text{ fixed } u \sim -\left(\frac{3}{2}, \frac{1}{2}\right) \beta(-u)^{1/2} \frac{(s+u-4m^2)^{1/2}}{m} \frac{(bs\alpha(u) - 1)}{\alpha(0) \Gamma[\alpha(u)] \sin \pi \alpha(u)}. \tag{7}
\]

It satisfies the correct threshold behavior \(\alpha(-4)^{1/2}\) for small \(u\).

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**FOOTNOTE AND REFERENCES**

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