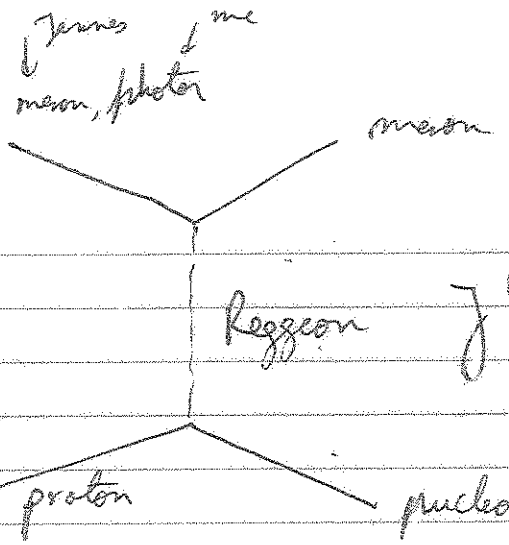
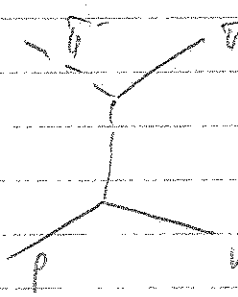


→ Show slide 1, meson types

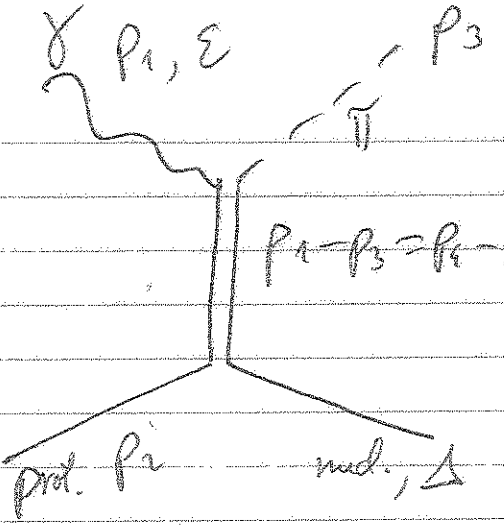
- $\bar{5}$ needed for analytic continuation:
  avoids divergences in left-hand cut (u-channel)
  by introducing PWA of definite signature
- For high s $\eta = +1$ exchange dominates
  (be careful with the $\bar{\nu}$!)

Example of possible exchanges:



$C = (-1)^2 = 1$
$\eta = (-1)^2 = 1$
$I = 1$
} only $\bar{5}$ exchange!

→ Show slide 2, possible exchanges



We want to study and understand observables.
→ Show slide 3 sneak preview

$\frac{d\sigma}{dt}$, Σ → need amplitudes

Photoproduction

How can I construct the amplitudes?
Building blocks:
masses, energies, p_i, $\not{\varepsilon}$
But $p_{2,4} \rightarrow m_{2,4}$

$p_3 \Rightarrow p_1 + p_2 - p_4 \rightarrow p_1, m_2, m_4$

So only known scalars, p_1, q

Amplitude pieces fall into: $c_1 \text{scalars} + c_2 \not{p}_1 + c_3 \not{q} + c_4 \not{p}$

Is there more convenient format?

→ Show slide 4, gauge invariance

→ Show slide 9,

$\frac{d\sigma}{dt}$, $\gamma p \to \pi^0 p$. First of all, helicity-flip

↑ top vertex (bottom vertex mainly non-fl due to w dep

Reminder (slide 2): exchanges ω, ρ, h_1, b_1

Natural: ω, ρ with trajectory $\alpha_V = 0.5 + 0.9t$ ↑ spin

$$R(s,t) = \frac{1 - e^{-i\pi\alpha(t)}}{2\sin(\pi\alpha(t))} f(\alpha) \left(\frac{s}{s_0}\right)^{\alpha(t)}$$

$1 - e^{-i\pi\alpha(t)}$: 0 for even α; $2\sin(\pi\alpha(t))$: 0 for integer α

$f(\alpha)$: function that cancels poles and gives 0 at even spin, e.g. $\alpha(\alpha+1)(\alpha+2)$

$\alpha_V = 0$ for $t = -0.56$ } $R(s,t) = 0$! Dips
$\alpha_V = -2$ for $t = -2.56$ }

Dip at $\alpha_V = 0$ is filled. Why? Other trajectories:

Unnatural: h_1, b_1

$\alpha_A = 0.7t$

Regge-Pomeron cut:

$\alpha_c = 0.5 + 0.2t$ Very flat!

→ Slide 10

$$\Sigma = \frac{\text{natural} \mp \text{unnatural}}{\text{nat.} + \text{unnat.}} \qquad \frac{N - U}{N + U} \xrightarrow{t \to} 1$$

natural dominance

At dip, $N \to 0 \Rightarrow \Sigma \to -\frac{U}{U} = -1$; filled up!