Show slide 1, meson types

- J needed for analytic continuation
  - Avoids divergence in left-hand (u-channel) by introducing PWA of definite signature

- For high s, $\eta = 1$ exchange dominates (be careful with the $T$!) (be careful with the $T$!)

Example of possible exchange:

\[
\begin{array}{c}
\text{p} \\
\text{V} \\
\text{p} \\
\text{h}
\end{array}
\]

\[ G = (-1)^I = 1 \]
\[ I = 1 \]

Only 3 exchange

Show slide 2, possible exchanges
Photo production

We want to study and understand observables.

Show slide 3: Small primes

\[ \frac{d\sigma}{d^{2}q}, \bar{\Sigma} \rightarrow \text{need amplitudes} \]

How can I construct the amplitudes?

Building blocks:

- masses, energies, \( q_1, q_2 \)
- But \( q_1 + q_2 = p_3 \)

\[ p_3 = q_1 + q_2 - q_4 \rightarrow q_1, m, m' \]

So only known scalars, \( p_1, q_4 \).

Amplitude piece fall into:

\[ c_1 \text{ Scalars} + c_2 \text{ } q_4 + c_3 \phi + c_4 \phi' \]

Is there a more convenient form?

Show slide 4, gauge invariance
Show slide 9.

$\frac{d\phi}{dt}, \phi \to \tilde{\phi} \phi$

First of all, helicity-flip.

Reminder (slide 2): exchanges $Q, g, h, b$

Natural: $Q, g$ with trajectory $\alpha_v = 0.5 + 0.9t$

$R(s,t) = \frac{t - 2 \Delta t(t)}{2s \Delta v(t)} f(x) \left( \frac{s}{s_0} \right)^{\alpha_v(t)}$

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

$\alpha_v = 0$ for $t = -2.56$ \( R(6,1) = 0 \) Dips

$\alpha_v = 0$ for $t = -0.56$ \( R(6,1) < 0 \) Dips

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

Unnatural: $h, b, c$

$\alpha_v = 0.7t$

Regge - common cut:

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

$\rightarrow$ Slide 10

$Z = \frac{\text{natural}}{\text{unnatural}} = \frac{N - U}{U + N} \rightarrow 1$

At $t = 0$, $N \to 0 \Rightarrow Z \to -\frac{u}{u} = -1$; filled up!