

Particle spectrograph

Wave operator and propagator

$$S = \iiint (f^{\alpha\beta} \tau_{\alpha\beta} + \frac{1}{2} t_1 (2 \partial_{\beta} f^{\mu}{}_{\mu} \partial^{\beta} f^{\alpha}{}_{\alpha} + 2 \partial_{\beta} f^{\alpha\beta} \partial_{\mu} f^{\mu}{}_{\alpha} - 4 \partial^{\beta} f^{\alpha}{}_{\alpha} \partial_{\mu} f^{\mu}{}_{\beta} + 2 \partial_{\alpha} f_{\beta\mu} \partial^{\mu} f^{\alpha\beta} + \partial_{\alpha} f_{\mu\beta} \partial^{\mu} f^{\alpha\beta} - \partial_{\beta} f_{\alpha\mu} \partial^{\mu} f^{\alpha\beta} - \partial_{\mu} f_{\alpha\beta} \partial^{\mu} f^{\alpha\beta} - \partial_{\mu} f_{\beta\alpha} \partial^{\mu} f^{\alpha\beta})) [t, x, y, z] d^4 z d^4 y d^4 x d^4 t$$

Spin-parity form	Covariant form	Multiplicities
$\begin{smallmatrix} \#2 \\ 0^+ \tau = 0 \end{smallmatrix}$	$\partial_{\beta} \partial_{\alpha} \tau^{\alpha\beta} = 0$	1
$\begin{smallmatrix} \#2 \\ 1^- \tau \end{smallmatrix}$	$\partial_{\chi} \partial_{\beta} \partial^{\alpha} \tau^{\beta\chi} = \partial_{\chi} \partial^{\alpha} \partial_{\beta} \tau^{\alpha\beta}$	3
$\begin{smallmatrix} \#1 \\ 1^- \tau \end{smallmatrix}$	$\partial_{\chi} \partial_{\beta} \partial^{\alpha} \tau^{\beta\chi} = \partial_{\chi} \partial^{\alpha} \partial_{\beta} \tau^{\beta\alpha}$	3
$\begin{smallmatrix} \#1 \\ 1^+ \tau \end{smallmatrix}$	$\partial_{\chi} \partial^{\alpha} \tau^{\beta\chi} + \partial_{\beta} \partial^{\alpha} \tau^{\chi\alpha} = \partial_{\chi} \partial^{\alpha} \tau^{\alpha\beta} + \partial_{\beta} \partial^{\alpha} \tau^{\chi\beta}$	3
Total expected gauge generators:		10

$\begin{smallmatrix} \#1 \\ 2^+ f \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 2^+ f \alpha\beta \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 2^+ \tau \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 2^+ \tau \alpha\beta \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 0^+ \tau \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \#2 \\ 0^+ \tau \end{smallmatrix}$
$\begin{smallmatrix} \#1 \\ 1^+ f \alpha\beta \end{smallmatrix}$	$-k^2 t_1$	$\begin{smallmatrix} \#1 \\ 1^+ \tau \uparrow \end{smallmatrix}$	$-\frac{1}{k^2 t_1}$	$\begin{smallmatrix} \#1 \\ 0^+ \tau \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \frac{1}{2k^2 t_1} \\ 0 \end{smallmatrix}$
$\begin{smallmatrix} \#1 \\ 1^+ f \alpha\beta \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 1^+ f \alpha \end{smallmatrix}$	$\begin{smallmatrix} \#2 \\ 1^+ f \alpha \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 1^+ \tau \alpha\beta \end{smallmatrix}$	$\begin{smallmatrix} \#1 \\ 1^+ \tau \alpha \end{smallmatrix}$	$\begin{smallmatrix} \#2 \\ 1^+ \tau \alpha \end{smallmatrix}$
$\begin{smallmatrix} \#1 \\ 1^+ f \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 & 0 \end{smallmatrix}$
$\begin{smallmatrix} \#1 \\ 1^+ f \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$
$\begin{smallmatrix} \#2 \\ 1^- f \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha \\ 0 & 0 & 0 \end{smallmatrix}$
$\begin{smallmatrix} \#1 \\ 0^+ f \uparrow \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 2k^2 t_1 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \alpha\beta \\ 0 & 0 \end{smallmatrix}$

Massive and massless spectra

Massless particle

Pole residue: $\frac{1}{t_1} > 0$

Polarisations: 2

$K^{\mu} = (p, 0, 0, p)$

(No particles)

Unitarity conditions