Particle spectrograph

Wave operator and propagator

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

$$\begin{array}{c|cc} & \overset{\#1}{0}^{+}f & \overset{\#2}{0}^{+}f \\ \hline \overset{\#1}{0}^{+}f^{\dagger} & 2k^2 t_1 & 0 \\ \overset{\#2}{0}^{+}f^{\dagger} & 0 & 0 \end{array}$$

$$\begin{array}{cc|c} \overset{\#2}{0}^{+}\tau^{\dagger} & \overset{\#1}{0}^{+}\tau^{\dagger} & \\ \hline 0 & \frac{1}{2k^2 t_1} & \overset{\#1}{0}^{+}\tau \\ 0 & 0 & \overset{\#2}{0}^{+}\tau \end{array}$$

$$\begin{array}{ccccc|c} \overset{\#2}{1}^{-}\tau^{\dagger\alpha} & \overset{\#1}{1}^{-}\tau^{\dagger\alpha} & \overset{\#1}{1}^{-}\mathcal{T}^{\dagger\alpha} & \overset{\#1}{1}^{+}\tau^{\dagger\alpha\beta} & \overset{\#1}{1}^{+}\mathcal{T}^{\dagger\alpha\beta} & \\ \hline 0 & 0 & 0 & 0 & \frac{1}{\frac{k^2\alpha}{3}+\beta} & \overset{\#1}{1}^{+}\mathcal{T}_{\alpha\beta} \\ 0 & 0 & 0 & 0 & 0 & \overset{\#1}{1}^{+}\tau_{\alpha\beta} \\ 0 & 0 & \frac{1}{\beta} & 0 & 0 & \overset{\#1}{1}^{-}\mathcal{T}_{\alpha} \\ & & 0 & & 0 & \overset{\#1}{1}^{-}\tau_{\alpha} \\ 0 & 0 & 0 & 0 & 0 & \overset{\#2}{1}^{-}\tau_{\alpha} \end{array}$$

$$\begin{array}{ccccc|c} \overset{\#2}{1}^{-}f^{\dagger\alpha} & \overset{\#1}{1}^{-}f^{\dagger\alpha} & \overset{\#1}{1}^{-}\mathcal{B}^{\dagger\alpha} & \overset{\#1}{1}^{+}f^{\dagger\alpha\beta} & \overset{\#1}{1}^{+}\mathcal{B}^{\dagger\alpha\beta} & \\ \hline 0 & 0 & 0 & 0 & \frac{k^2\alpha}{3}+\beta & \overset{\#1}{1}^{+}\mathcal{B}_{\alpha\beta} \\ 0 & 0 & 0 & 0 & 0 & \overset{\#1}{1}^{+}f_{\alpha\beta} \\ 0 & 0 & \beta & 0 & 0 & \overset{\#1}{1}^{-}\mathcal{B}_{\alpha} \\ & & 0 & & & \overset{\#1}{1}^{-}f_{\alpha} \\ 0 & 0 & 0 & 0 & 0 & \overset{\#2}{1}^{-}f_{\alpha} \end{array}$$

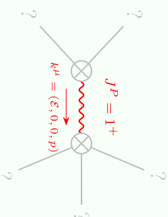
$$\begin{array}{c|c} & \overset{\#1}{2}^{+}f_{\alpha\beta} \\ \hline \overset{\#1}{2}^{+}f^{\dagger\alpha\beta} & -k^2 t_1 \end{array} \qquad \begin{array}{c|c} & \overset{\#1}{2}^{+}\tau_{\alpha\beta} \\ \hline \overset{\#1}{2}^{+}\tau^{\dagger\alpha\beta} & -\frac{1}{k^2 t_1} \end{array}$$

$$\begin{aligned} \mathcal{S} == \iiiint (&\beta\, \mathcal{B}_{\alpha\beta}\, \mathcal{B}^{\alpha\beta} + f^{\alpha\beta}\, \tau_{\alpha\beta} + \mathcal{B}^{\alpha\beta}\, \mathcal{T}_{\alpha\beta} - \tfrac{1}{3}\alpha\,(2\,\partial_\beta\mathcal{B}_{\alpha\chi} - \partial_\chi\mathcal{B}_{\alpha\beta})\,\partial^\chi\mathcal{B}^{\alpha\beta} + \\ &\tfrac{1}{2}t_1\,(2\,\partial_\beta f^{\chi}{}_{\chi}\,\partial^\beta f^{\alpha}{}_{\alpha} - 4\,\partial^\beta f^{\alpha}{}_{\alpha}\,\partial_\chi f_{\beta}{}^{\chi} + 2\,\partial_\beta f^{\alpha\beta}\,(\partial_\chi f_{\alpha}{}^{\chi} + 2\,\partial_\chi\mathcal{B}_{\alpha}{}^{\chi}) - 2\,\partial_\alpha\mathcal{B}^{\alpha\beta}\,\partial_\chi\mathcal{B}_{\beta}{}^{\chi} - \\ &4\,\partial^\beta f^{\alpha}{}_{\alpha}\,\partial_\chi\mathcal{B}_{\beta}{}^{\chi} + 2\,\partial_\alpha f_{\beta\chi}\,\partial^\chi f^{\alpha\beta} + \partial_\alpha f_{\chi\beta}\,\partial^\chi f^{\alpha\beta} - \partial_\beta f_{\alpha\chi}\,\partial^\chi f^{\alpha\beta} - 4\,\partial_\beta\mathcal{B}_{\alpha\chi}\,\partial^\chi f^{\alpha\beta} - \\ &\partial_\chi f_{\alpha\beta}\,\partial^\chi f^{\alpha\beta} - \partial_\chi f_{\beta\alpha}\,\partial^\chi f^{\alpha\beta} - 2\,\partial_\beta\mathcal{B}_{\alpha\chi}\,\partial^\chi\mathcal{B}^{\alpha\beta}))[t, x, y, z]\, dz\, dy\, dx\, dt \end{aligned}$$

Massive and massless spectra

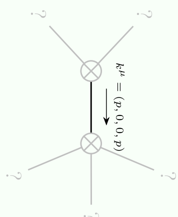
Massive particle

Pole residue:	$\frac{3}{\alpha} > 0$
Square mass:	$-\frac{3\beta}{\alpha} > 0$
Spin:	1
Parity:	Even



Massless particle

Pole residue:	$-\frac{1}{t_1} > 0$
Polarisations:	2



Unitarity conditions