Particle spectrograph

Wave operator and propagator

Spin-parity form	Covariant form	Multiplicities
$\overset{\#1}{0^-}\sigma == 0$	$\epsilon\eta_{\alpha\beta\chi\delta}\ \partial^\delta\sigma^{\alpha\beta\chi} == 0$	1
$\overset{\#2}{0^+}\tau == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == 0$	1
$\overset{\#1}{0^+}\tau - 2\, i\, k \overset{\#1}{0^+}\sigma == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == \partial_\beta\partial^\beta\tau^\alpha{}_\alpha + 2\ \partial_\chi\partial^\chi\partial_\beta\sigma^{\alpha\beta}{}_\alpha$	1
$\overset{\#2}{1^-}\tau^\alpha + 2\, i\, k \overset{\#2}{1^-}\sigma^\alpha == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta} + 2\ \partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	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
$\overset{\#1}{1^+}\tau^{\alpha\beta} + i\, k \overset{\#2}{1^+}\sigma^{\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} + 2\ \partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 2\ \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha} + 2\ \partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
$\overset{\#1}{2^+}\tau^{\alpha\beta} - 2\, i\, k \overset{\#1}{2^+}\sigma^{\alpha\beta} == 0$	$-i(4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\tau^{\chi\delta} + 2\ \partial_\delta\partial^\delta\partial^\beta\partial^\alpha\tau^\chi{}_\chi - 3\ \partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\beta\chi} - 3\ \partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\chi\beta} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\alpha\chi} - 3\ \partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\chi\alpha} + 3\ \partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\alpha\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\beta\alpha} + 4\ i\ k^\chi\ \partial_\epsilon\partial_\chi\partial^\beta\partial^\alpha\sigma^{\delta\epsilon}{}_\delta - 6\ i\ k^\chi\ \partial_\epsilon\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\delta\epsilon} - 6\, i\ k^\chi\ \partial_\epsilon\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\delta\epsilon} + 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\tau^{\chi\delta} + 6\, i\ k^\chi\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\alpha\delta\beta} + 6\ i\ k^\chi\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\beta\delta\alpha} - 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\tau^\chi{}_\chi - 4\ i\ \eta^{\alpha\beta}\ k^\chi\ \partial_\phi\partial^\phi\partial_\epsilon\partial_\chi\sigma^{\delta\epsilon}{}_\delta) == 0$	5
Total expected gauge generators:		17

	$\overset{\#1}{1^+}\sigma_{\alpha\beta}$	$\overset{\#2}{1^+}\sigma_{\alpha\beta}$	$\overset{\#1}{1^+}\tau_{\alpha\beta}$	$\overset{\#1}{1^-}\sigma_\alpha$	$\overset{\#2}{1^-}\sigma_\alpha$	$\overset{\#1}{1^-}\tau_\alpha$	$\overset{\#2}{1^-}\tau_\alpha$
$\overset{\#1}{1^+}\sigma\dagger^{\alpha\beta}$	$\frac{1}{k^2 r_5}$	$\frac{1}{\sqrt{2}(k^2 r_5+k^4 r_5)}$	$\frac{i}{\sqrt{2}(k r_5+k^3 r_5)}$	0	0 0		0
$\overset{\#2}{1^+}\sigma\dagger^{\alpha\beta}$	$\frac{1}{\sqrt{2}(k^2 r_5+k^4 r_5)}$	$\frac{6k^2 r_5+t_1}{2(k+k^3)^2 r_5 t_1}$	$\frac{i(6k^2 r_5+t_1)}{2k(1+k^2)^2 r_5 t_1}$	0	0 0		0
$\overset{\#1}{1^+}\tau\dagger^{\alpha\beta}$	$-\frac{i}{\sqrt{2}(k r_5+k^3 r_5)}$	$-\frac{i(6k^2 r_5+t_1)}{2k(1+k^2)^2 r_5 t_1}$	$\frac{6k^2 r_5+t_1}{2(1+k^2)^2 r_5 t_1}$	0	0 0		0
$\overset{\#1}{1^-}\sigma\dagger^\alpha$	0	0	0 0		$\frac{\sqrt{2}}{t_1+2k^2 t_1}$	0	$\frac{2ik}{t_1+2k^2 t_1}$
$\overset{\#2}{1^-}\sigma\dagger^\alpha$	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2 t_1}$	$\frac{-2k^2 r_5+t_1}{(t_1+2k^2 t_1)^2}$	0	$-\frac{i\sqrt{2}k(2k^2 r_5-t_1)}{(t_1+2k^2 t_1)^2}$
$\overset{\#1}{1^-}\tau\dagger^\alpha$	0	0	0 0		0	0	0
$\overset{\#2}{1^-}\tau\dagger^\alpha$	0	0	0	$-\frac{2ik}{t_1+2k^2 t_1}$	$\frac{i\sqrt{2}k(2k^2 r_5-t_1)}{(t_1+2k^2 t_1)^2}$	0	$\frac{-4k^4 r_5+2k^2 t_1}{(t_1+2k^2 t_1)^2}$

$$S == \iiiint(f^{\alpha\beta}\ \tau_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + \tfrac{1}{3}t_1(3\ \mathcal{A}^{\alpha\iota}{}_\alpha\ \mathcal{A}_\iota{}^\theta{}_\theta - 6\ \mathcal{A}_\alpha{}^\theta{}_\theta\ \partial_\iota f^{\alpha\iota} + 6\ \mathcal{A}_\iota{}^\theta{}_\theta\ \partial^\iota f^\alpha{}_\alpha - 3\ \partial_\iota f^\theta{}_\theta\partial^\iota f^\alpha{}_\alpha - 3\ \partial_\iota f^{\alpha\iota}\ \partial_\theta f_\alpha{}^\theta + 6\ \partial^\iota f^\alpha{}_\alpha\ \partial_\theta f_\iota{}^\theta + 2\ \mathcal{A}_{\iota\theta\alpha}\ \partial^\theta f^{\alpha\iota} - 2\ \partial_\alpha f_{\iota\theta}\ \partial^\theta f^{\alpha\iota} - 2\ \partial_\alpha f_{\theta\iota}\ \partial^\theta f^{\alpha\iota} + \partial_\iota f_{\alpha\theta}\ \partial^\theta f^{\alpha\iota} + 2\ \partial_\theta f_{\alpha\iota}\ \partial^\theta f^{\alpha\iota} + \partial_\theta f_{\iota\alpha}\ \partial^\theta f^{\alpha\iota} + \mathcal{A}_{\alpha\iota\theta}\ (\mathcal{A}^{\alpha\iota\theta} + 2\ \partial^\theta f^{\alpha\iota}) + \mathcal{A}_{\alpha\theta\iota}\ (\mathcal{A}^{\alpha\iota\theta} + 4\ \partial^\theta f^{\alpha\iota})) + r_5(\partial_\iota\mathcal{A}_\theta{}^\kappa{}_\kappa\ \partial^\theta\mathcal{A}^{\alpha\iota}{}_\alpha - \partial_\theta\mathcal{A}_\iota{}^\kappa{}_\kappa\ \partial^\theta\mathcal{A}^{\alpha\iota}{}_\alpha - (\partial_\alpha\mathcal{A}^{\alpha\iota\theta} - 2\ \partial^\theta\mathcal{A}^{\alpha\iota}{}_\alpha)(\partial_\kappa\mathcal{A}_\iota{}^\kappa{}_\theta - \partial_\kappa\mathcal{A}_\theta{}^\kappa{}_\iota)))[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\overset{\#1}{0^+}\mathcal{A}$	$\overset{\#1}{0^+}f$	$\overset{\#2}{0^+}f$	$\overset{\#1}{0^-}\mathcal{A}$
$\overset{\#1}{0^+}\mathcal{A}\dagger$	$-t_1$	$i\sqrt{2}\,k\,t_1$	0	0
$\overset{\#1}{0^+}f\dagger$	$-i\sqrt{2}\,k\,t_1$	$-2k^2 t_1$	0	0
$\overset{\#2}{0^+}f\dagger$	0	0	0	0
$\overset{\#1}{0^-}\mathcal{A}\dagger$	0	0	0	0

	$\overset{\#1}{0^+}\sigma$	$\overset{\#1}{0^+}\tau$	$\overset{\#2}{0^+}\tau$	$\overset{\#1}{0^-}\sigma$
$\overset{\#1}{0^+}\sigma\dagger$	$-\frac{1}{(1+2k^2)^2 t_1}$	$\frac{i\sqrt{2}k}{(1+2k^2)^2 t_1}$	0	0
$\overset{\#1}{0^+}\tau\dagger$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2 t_1}$	$-\frac{2k^2}{(1+2k^2)^2 t_1}$	0	0
$\overset{\#2}{0^+}\tau\dagger$	0	0	0	0
$\overset{\#1}{0^-}\sigma\dagger$	0	0	0	0

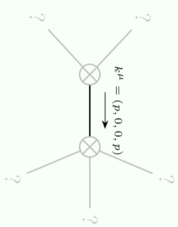
	$\overset{\#1}{2^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#1}{2^+}f_{\alpha\beta}$	$\overset{\#1}{2^-}\mathcal{A}_{\alpha\beta\chi}$
$\overset{\#1}{2^+}\mathcal{A}\dagger^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{i\,k\,t_1}{\sqrt{2}}$	0
$\overset{\#1}{2^+}f\dagger^{\alpha\beta}$	$\frac{i\,k\,t_1}{\sqrt{2}}$	$k^2 t_1$	0
$\overset{\#1}{2^-}\mathcal{A}\dagger^{\alpha\beta\chi}$	0	0	$\frac{t_1}{2}$

	$\overset{\#1}{2^+}\sigma_{\alpha\beta}$	$\overset{\#1}{2^+}\tau_{\alpha\beta}$	$\overset{\#1}{2^-}\sigma_{\alpha\beta\chi}$
$\overset{\#1}{2^+}\sigma\dagger^{\alpha\beta}$	$\frac{2}{(1+2k^2)^2 t_1}$	$-\frac{2i\sqrt{2}k}{(1+2k^2)^2 t_1}$	0
$\overset{\#1}{2^+}\tau\dagger^{\alpha\beta}$	$\frac{2i\sqrt{2}k}{(1+2k^2)^2 t_1}$	$\frac{4k^2}{(1+2k^2)^2 t_1}$	0
$\overset{\#1}{2^-}\sigma\dagger^{\alpha\beta\chi}$	0	0	$\frac{2}{t_1}$

	$\overset{\#1}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#2}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#1}{1^+}f_{\alpha\beta}$	$\overset{\#1}{1^-}\mathcal{A}_\alpha$	$\overset{\#2}{1^-}\mathcal{A}_\alpha$	$\overset{\#1}{1^-}f_\alpha$	$\overset{\#2}{1^-}f_\alpha$
$\overset{\#1}{1^+}\mathcal{A}\dagger^{\alpha\beta}$	$k^2 r_5 + \frac{t_1}{6}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{i\,k\,t_1}{3\sqrt{2}}$	0	0	0	0
$\overset{\#2}{1^+}\mathcal{A}\dagger^{\alpha\beta}$	$-\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	$\frac{i\,k\,t_1}{3}$	0	0	0	0
$\overset{\#1}{1^+}f\dagger^{\alpha\beta}$	$\frac{i\,k\,t_1}{3\sqrt{2}}$	$-\frac{1}{3}i\,k\,t_1$	$\frac{k^2 t_1}{3}$	0	0	0	0
$\overset{\#1}{1^-}\mathcal{A}\dagger^\alpha$	0	0 0		$k^2 r_5 - \frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$i\,k\,t_1$
$\overset{\#2}{1^-}\mathcal{A}\dagger^\alpha$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$\overset{\#1}{1^-}f\dagger^\alpha$	0	0 0		0	0	0	0
$\overset{\#2}{1^-}f\dagger^\alpha$	0	0 0		$-i\,k\,t_1$	0	0	0

Massive and massless spectra

Massless particle	
Pole residue:	$\frac{1}{r_5 t_1^2 p^2} > 0$
Polarisations:	2



(No particles)

Unitarity conditions