Particle spectrograph

Wave operator and propagator

Spin-parity form	Covariant form	Multiplicities
$^{\#2}0^{+}\tau == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == 0$	1
$^{\#1}0^{+}\sigma == 0$	$\partial_\beta\sigma^{\alpha\beta}{}_{\alpha} == 0$	1
$^{\#2}1^{-}\tau^{\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta}$	3
$^{\#1}1^{-}\tau^{\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$^{\#2}1^{-}\sigma^{\alpha} == 0$	$\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi} == 0$	3
$^{\#1}1^{-}\sigma^{\alpha} == 0$	$\partial_\chi\partial^\alpha\sigma^{\beta\chi}{}_{\beta} + \partial_\chi\partial^\chi\sigma^{\alpha\beta}{}_{\beta} == \partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$^{\#1}1^{+}\tau^{\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha}$	3
$^{\#2}1^{+}\sigma^{\alpha\beta} == 0$	$\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} == \partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
$^{\#1}1^{+}\sigma^{\alpha\beta} == 0$	$\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta} == \partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\chi\alpha}$	3
$^{\#1}2^{+}\sigma^{\alpha\beta} == 0$ 2	$\partial_\delta\partial^\beta\partial^\alpha\sigma^{\chi\delta}{}_{\chi} + 3(\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\chi\alpha}) == 3\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 3\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta} + 2\eta^{\alpha\beta}\partial_\epsilon\partial^\epsilon\partial_\delta\sigma^{\chi\delta}{}_{\chi}$	5
$^{\#1}2^{-}\sigma^{\alpha\beta\chi} == 0$ 3	$\partial_\epsilon\partial_\delta\partial^\chi\partial^\alpha\sigma^{\beta\delta\epsilon} + 3\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\alpha\sigma^{\beta\delta}{}_{\delta} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\alpha\chi\delta} + 4\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\alpha\delta\chi} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\chi\delta\alpha} + 4\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\alpha\beta\delta} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\alpha\delta\beta} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\beta\chi\alpha} + 3\eta^{\beta\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial^\alpha\sigma^{\delta\epsilon}{}_{\delta} + 3\eta^{\alpha\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\sigma^{\beta\delta\epsilon} + 3\eta^{\beta\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\sigma^{\alpha\delta}{}_{\delta} == 3\partial_\epsilon\partial_\delta\partial^\chi\partial^\beta\sigma^{\alpha\delta\epsilon} + 3\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\beta\sigma^{\alpha\delta}{}_{\delta} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\beta\chi\delta} + 4\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\beta\delta\chi} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\chi\delta\beta} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\beta\delta\alpha} + 4\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\alpha\beta\chi} + 2\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\alpha\chi\beta} + 3\eta^{\alpha\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial^\beta\sigma^{\delta\epsilon}{}_{\delta} + 3\eta^{\beta\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\sigma^{\alpha\delta\epsilon} + 3\eta^{\alpha\chi}\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\sigma^{\beta\delta}{}_{\delta}$	5
Total expected gauge generators:		33

$$S == \iiiint (f^{\alpha\beta}\,\tau_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + \beta_1(-4\,\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\,\partial_\beta f^{\alpha\beta} + 4\,\partial_\beta\mathcal{A}^{\alpha\beta}{}_{\alpha} + 4\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\,\partial^\beta f^{\alpha}{}_{\alpha} - 2\,\partial_\beta f^{\chi}{}_{\chi}\,\partial^\beta f^{\alpha}{}_{\alpha} - 2\,\partial_\beta f^{\alpha\beta}\,\partial_\chi f_{\alpha}{}^{\chi} + 4\,\partial^\beta f^{\alpha}{}_{\alpha}\,\partial_\chi f_{\beta}{}^{\chi} - 4\,f^{\alpha\beta}\,(\partial_\beta\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi} - \partial_\chi\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}) - 4\,f^{\alpha}{}_{\alpha}\,\partial_\chi\mathcal{A}^{\beta\chi}{}_{\beta} + 4\,\mathcal{A}_{\alpha\chi\beta}\,\partial^\chi f^{\alpha\beta} - 2\,\partial_\alpha f_{\beta\chi}\,\partial^\chi f^{\alpha\beta} - \partial_\alpha f_{\chi\beta}\,\partial^\chi f^{\alpha\beta} + \partial_\beta f_{\alpha\chi}\,\partial^\chi f^{\alpha\beta} + \partial_\chi f_{\alpha\beta}\,\partial^\chi f^{\alpha\beta} + \partial_\chi f_{\beta\alpha}\,\partial^\chi f^{\alpha\beta}) + \frac{1}{3}\alpha_3(4\,\partial_\beta\mathcal{A}_{\alpha\chi\delta} - 2\,\partial_\beta\mathcal{A}_{\alpha\delta\chi} + 2\,\partial_\beta\mathcal{A}_{\chi\delta\alpha} - \partial_\chi\mathcal{A}_{\alpha\beta\delta} + \partial_\delta\mathcal{A}_{\alpha\beta\chi} - 2\,\partial_\delta\mathcal{A}_{\alpha\chi\beta})\,\partial^\delta\mathcal{A}^{\alpha\beta\chi})[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$^{\#1}0^{+}\sigma$	$^{\#1}0^{+}\tau$	$^{\#2}0^{+}\tau$	$^{\#1}0^{-}\sigma$
$^{\#1}0^{+}\sigma\dagger$	0	0	0	0
$^{\#1}0^{+}\tau\dagger$	0	$-\frac{1}{4\beta_1 k^2}$	0	0
$^{\#2}0^{+}\tau\dagger$	0	0	0	0
$^{\#1}0^{-}\sigma\dagger$	0	0	0	$\frac{1}{\alpha_3 k^2}$

	$^{\#1}2^{+}\sigma_{\alpha\beta}$	$^{\#1}2^{+}\tau_{\alpha\beta}$	$^{\#1}2^{-}\sigma_{\alpha\beta\chi}$
$^{\#1}2^{+}\sigma\dagger^{\alpha\beta}$	0	0	0
$^{\#1}2^{+}\tau\dagger^{\alpha\beta}$	0	$\frac{1}{2\beta_1 k^2}$	0
$^{\#1}2^{-}\sigma\dagger^{\alpha\beta\chi}$	0	0	0

	$^{\#1}0^{+}\mathcal{A}$	$^{\#1}0^{+}f$	$^{\#2}0^{+}f$	$^{\#1}0^{-}\mathcal{A}$
$^{\#1}0^{+}\mathcal{A}\dagger$	0	0	0	0
$^{\#1}0^{+}f\dagger$	0	$-4\beta_1 k^2$	0	0
$^{\#2}0^{+}f\dagger$	0	0	0	0
$^{\#1}0^{-}\mathcal{A}\dagger$	0	0	0	$\alpha_3 k^2$

	$^{\#1}2^{+}\mathcal{A}_{\alpha\beta}$	$^{\#1}2^{+}f_{\alpha\beta}$	$^{\#1}2^{-}\mathcal{A}_{\alpha\beta\chi}$
$^{\#1}2^{+}\mathcal{A}\dagger^{\alpha\beta}$	0	0	0
$^{\#1}2^{+}f\dagger^{\alpha\beta}$	0	$2\beta_1 k^2$	0
$^{\#1}2^{-}\mathcal{A}\dagger^{\alpha\beta\chi}$	0	0	0

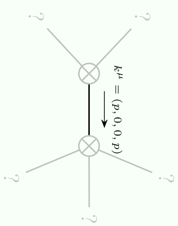
	$^{\#1}1^{+}\mathcal{A}_{\alpha\beta}$	$^{\#2}1^{+}\mathcal{A}_{\alpha\beta}$	$^{\#1}1^{+}f_{\alpha\beta}$	$^{\#1}1^{-}\mathcal{A}_{\alpha}$	$^{\#2}1^{-}\mathcal{A}_{\alpha}$	$^{\#1}1^{-}f_{\alpha}$	$^{\#2}1^{-}f_{\alpha}$
$^{\#1}1^{+}\mathcal{A}\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#2}1^{+}\mathcal{A}\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#1}1^{+}f\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#1}1^{-}\mathcal{A}\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#2}1^{-}\mathcal{A}\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#1}1^{-}f\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#2}1^{-}f\dagger^{\alpha}$	0	0	0		0	0	0

	$^{\#1}1^{+}\sigma_{\alpha\beta}$	$^{\#2}1^{+}\sigma_{\alpha\beta}$	$^{\#1}1^{+}\tau_{\alpha\beta}$	$^{\#1}1^{-}\sigma_{\alpha}$	$^{\#2}1^{-}\sigma_{\alpha}$	$^{\#1}1^{-}\tau_{\alpha}$	$^{\#2}1^{-}\tau_{\alpha}$
$^{\#1}1^{+}\sigma\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#2}1^{+}\sigma\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#1}1^{+}\tau\dagger^{\alpha\beta}$	0	0	0		0	0	0
$^{\#1}1^{-}\sigma\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#2}1^{-}\sigma\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#1}1^{-}\tau\dagger^{\alpha}$	0	0	0		0	0	0
$^{\#2}1^{-}\tau\dagger^{\alpha}$	0	0	0		0	0	0

Massive and massless spectra

Polarisations:	2
Poleresidue:	$\frac{1}{\beta_1} > 0$

Massless particle



(No particles)

Unitarity conditions