Particle spectrograph

Wave operator and propagator

Source constraints		
SO(3) irreps	Fundamental fields	Multiplicities
$\sigma^{\#1}_{0^+} == 0$	$\partial_\beta \sigma^{\alpha\beta}{}_\alpha == 0$	1
$\sigma^{\#2}_{1^-}{}^{\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\beta\chi} == 0$	3
$\sigma^{\#2}_{1^+}{}^{\alpha\beta} == 0$	$\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + \partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\beta\chi} == \partial_\delta \partial^\beta \partial_\chi \sigma^{\alpha\chi\delta}$	3
$\sigma^{\#1}_{2^-}{}^{\alpha\beta\chi} == 0$	$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 constraints/gauge generators:		12

Quadratic (free) action

$$S == \iiiint \Big(\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + \tfrac{1}{3} r_2 \big(4\,\partial_\beta \omega_{\alpha\iota\theta} - 2\,\partial_\beta \omega_{\alpha\theta\iota} + 2\,\partial_\beta \omega_{\iota\theta\alpha} - \partial_\iota \omega_{\alpha\beta\theta} + \partial_\theta \omega_{\alpha\beta\iota} - 2\,\partial_\theta \omega_{\alpha\iota\beta}\big)\,\partial^\theta \omega^{\alpha\beta\iota} - \tfrac{1}{2} r_3 \big(\partial_\beta \omega_\iota{}^\theta{}_\theta\, \partial^\iota \omega^{\alpha\beta}{}_\alpha + \partial_\iota \omega_\beta{}^\theta{}_\theta\, \partial^\iota \omega^{\alpha\beta}{}_\alpha + \partial_\alpha \omega^{\alpha\beta\iota}\, \partial_\theta \omega_\beta{}^\theta{}_\iota - 2\,\partial^\iota \omega^{\alpha\beta}{}_\alpha\, \partial_\theta \omega_\beta{}^\theta{}_\iota + \partial_\alpha \omega^{\alpha\beta\iota}\, \partial_\theta \omega_\iota{}^\theta{}_\beta - 2\,\partial^\iota \omega^{\alpha\beta}{}_\alpha\, \partial_\theta \omega_\iota{}^\theta{}_\beta + 8\,\partial_\beta \omega_{\iota\theta\alpha}\, \partial^\theta \omega^{\alpha\beta\iota}\big) + r_5 \big(\partial_\iota \omega_\theta{}^\kappa{}_\kappa\, \partial^\theta \omega^{\alpha\iota}{}_\alpha - \partial_\theta \omega_\iota{}^\kappa{}_\kappa\, \partial^\theta \omega^{\alpha\iota}{}_\alpha - (\partial_\alpha \omega^{\alpha\iota\theta} - 2\,\partial^\theta \omega^{\alpha\iota}{}_\alpha)(\partial_\kappa \omega_\iota{}^\kappa{}_\theta - \partial_\kappa \omega_\theta{}^\kappa{}_\iota)\big)\Big)[t, x, y, z]\, dz\, dy\, dx\, dt$$

	$\omega^{\#1}_{2^+\,\alpha\beta}$	$\omega^{\#1}_{2^-\,\alpha\beta\chi}$
$\omega^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{3 k^2 r_3}{2}$	0
$\omega^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0

	$\sigma^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#2}_{1^+\,\alpha\beta}$	$\sigma^{\#1}_{1^-\,\alpha}$	$\sigma^{\#2}_{1^-\,\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{k^2 (2 r_3 + r_5)}$	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0	0	$\frac{2}{k^2 (r_3 + 2 r_5)}$	0
$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	0

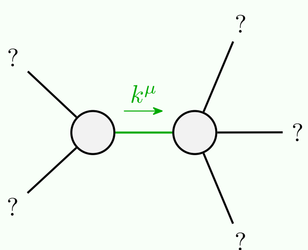
	$\sigma^{\#1}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	$\frac{1}{k^2 r_2}$

	$\omega^{\#1}_{0^+}$	$\omega^{\#1}_{0^-}$
$\omega^{\#1}_{0^+}\dagger$	0	0
$\omega^{\#1}_{0^-}\dagger$	0	$k^2 r_2$

	$\sigma^{\#1}_{2^+\,\alpha\beta}$	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{2}{3 k^2 r_3}$	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0

	$\omega^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#2}_{1^+\,\alpha\beta}$	$\omega^{\#1}_{1^-\,\alpha}$	$\omega^{\#2}_{1^-\,\alpha}$
$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$k^2 (2 r_3 + r_5)$	0	0	0
$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	0	0	0	0
$\omega^{\#1}_{1^-}\dagger^{\alpha}$	0	0	$\frac{1}{2} k^2 (r_3 + 2 r_5)$	0
$\omega^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	0

Massive and massless spectra



Quadratic pole	
Pole residue:	$-\frac{1}{r_3 (2 r_3 + r_5)(r_3 + 2 r_5)} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$r_3 < 0\ \&\&\ (r_5 < -\frac{r_3}{2}\ \|\ r_5 > -2 r_3)\ \|\ r_3 > 0\ \&\&\ -2 r_3 < r_5 < -\frac{r_3}{2}$