Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$$S_{\mathrm{F}} == \iiiint \Big(\tfrac{1}{6}\big(6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 3\,(r_3 + 2\,r_5)\,\partial_{\iota}\omega^{\kappa\lambda}{}_{\kappa}\,\partial^{\iota}\omega_{\lambda}{}^{\alpha}{}_{\alpha} + 4\,r_2\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa} - 2\,r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta} - 4\,r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta} + 3\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} - 6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} - 3\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} + 6\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} - 3\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} - 6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} + 6\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} + 12\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} + 2\,r_2\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta} + 4\,r_2\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta} - 4\,r_2\,\partial^{\beta}\omega_{\iota}{}^{\alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\iota} + 4\,r_2\,\partial^{\beta}\omega_{\iota}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\iota} - 24\,r_3\,\partial^{\beta}\omega_{\iota}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\iota} - 3\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa} + 6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa} + 3\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa} - 6\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}\big)\Big)[t, x, y, z]\,dz\,dy\,dx\,dt$$

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

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

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

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

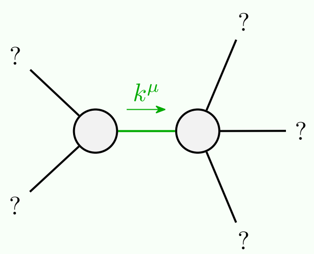
	$\sigma^{\#1}_{1^+}{}_{\alpha\beta}$	$\sigma^{\#2}_{1^+}{}_{\alpha\beta}$	$\sigma^{\#1}_{1^-}{}_{\alpha}$	$\sigma^{\#2}_{1^-}{}_{\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{k^2(2r_3+r_5)}$	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0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

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

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma^{\#1}_{0^+} == 0$	1
$\sigma^{\#2}_{1^-}{}^{\alpha} == 0$	3
$\sigma^{\#2}_{1^+}{}^{\alpha\beta} == 0$	3
$\sigma^{\#1}_{2^-}{}^{\alpha\beta\chi} == 0$	5
Total constraints:	12

Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

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