Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$$S_F == \iiint\int (\tfrac{1}{3}(3\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 3\,r_5\,\partial_l\omega^{\kappa\lambda}{}_{\kappa}\,\partial^{\prime}\omega_{\lambda\ \alpha}^{\ \alpha} - 2\,r_1\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa} - 2\,r_1\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta} + 2\,r_1\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta} - 3\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} + 3\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} - 3\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} + 6\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} + 2\,r_1\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta} - 2\,r_1\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta} + 2\,r_1\,\partial^{\beta}\omega_{l}^{\ \alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime} - 8\,r_1\,\partial^{\beta}\omega_{l}^{\ \lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime} + 3\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa} - 3\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa})) [t,\,x,\,y,\,z]\,dz\,dy\,dx\,dt$$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$k^2\,(2\,r_1 + r_5)$	0	0	0
$\omega_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	$k^2\,(r_1 + r_5)$	0
$\omega_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0

	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	$k^2\,r_1$
$\omega_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	0

	$\sigma_{0^+}^{\#1}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	0	0
$\sigma_{0^-}^{\#1}{}^{\dagger}$	0	0

	$\omega_{0^+}^{\#1}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	0	0
$\omega_{0^-}^{\#1}{}^{\dagger}$	0	0

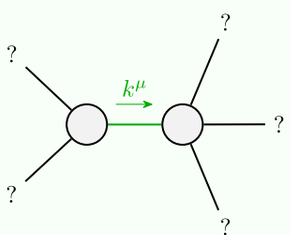
	$\sigma_{2^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	0
$\sigma_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	$\frac{1}{k^2\,r_1}$

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^-}^{\#1} == 0$	1
$\sigma_{0^+}^{\#1} == 0$	1
$\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	13

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{1}{k^2\,(2\,r_1 + r_5)}$	0	0	0
$\sigma_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	$\frac{1}{k^2\,(r_1 + r_5)}$	0
$\sigma_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0

Massive and massless spectra



Quadratic pole

Pole residue:	$-\frac{1}{r_1\,(r_1 + r_5)\,(2\,r_1 + r_5)} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$$r_1 < 0 \,\&\&\, (r_5 < -r_1 \,||\, r_5 > -2\,r_1) \,\|\, r_1 > 0 \,\&\&\, -2\,r_1 < r_5 < -r_1$$