Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$$S_F == \iiint\int \left(\frac{1}{6}\left(4\,t_2\;\omega_{\iota}{}^{\kappa\lambda}\;\omega_{\kappa\lambda}{}'+2\,t_2\;\omega_{\kappa\lambda}{}'\;\omega^{\kappa\lambda}{}_{\iota}+6\,f^{\alpha\beta}\;\tau_{\alpha\beta}+6\,\omega^{\alpha\beta\chi}\;\sigma_{\alpha\beta\chi}-6\,r_5\,\partial_{\iota}\omega'^{\kappa\lambda}{}_{\kappa}\right.\right.$$
$$\partial'\omega_{\lambda}{}^{\alpha}{}_{\alpha}+4\,r_2\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}-2\,r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta}-4\,r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta}-$$
$$6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+6\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}-6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+$$
$$12\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+t_2\,\partial^{\alpha}f_{\theta\kappa}\,\partial^{\kappa}f_{\alpha}{}^{\theta}-t_2\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\alpha}{}^{\theta}+t_2\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\,\partial^{\kappa}f_{\alpha\lambda}+$$
$$2\,t_2\;\omega_{\iota\theta\kappa}\,\partial^{\kappa}f'^{\iota\theta}-4\,t_2\;\omega_{\iota\kappa\theta}\,\partial^{\kappa}f'^{\iota\theta}-2\,t_2\;\omega_{\theta\iota\kappa}\,\partial^{\kappa}f'^{\iota\theta}+4\,t_2\;\omega_{\theta\kappa\iota}\,\partial^{\kappa}f'^{\iota\theta}-$$
$$t_2\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\,\partial^{\kappa}f_{\lambda\alpha}-t_2\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda}{}^{\theta}+2\,r_2\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}+$$
$$4\,r_2\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}-4\,r_2\,\partial^{\beta}\omega_{\iota}{}^{\alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}'+4\,r_2\,\partial^{\beta}\omega_{\iota}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}'+$$
$$\left.\left.6\,r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}-6\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}\right)\right)[t,\,x,\,y,\,z]\,dz\,dy\,dx\,dt$$

	$\sigma_{1^+}^{\#2\,\alpha\beta}$	$\tau_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^-}^{\#1\,\alpha}$	$\sigma_{1^-}^{\#2\,\alpha}$	$\tau_{1^-}^{\#1\,\alpha}$	$\tau_{1^-}^{\#2\,\alpha}$
$\sigma_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$-\frac{\sqrt{2}}{k^2\,r_5+k^4\,r_5}$	$-\frac{i\,\sqrt{2}}{k\,r_5+k^3\,r_5}$	0	0	0	0
$\sigma_{1^+}^{\#2\,\alpha\beta}\,\dagger$	$\frac{3\,k^2\,r_5+2\,t_2}{(k+k^3)^2\,r_5\,t_2}$	$\frac{i\,(3\,k^2\,r_5+2\,t_2)}{k\,(1+k^2)^2\,r_5\,t_2}$	0	0	0	0
$\tau_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$-\frac{i\,(3\,k^2\,r_5+2\,t_2)}{k\,(1+k^2)^2\,r_5\,t_2}$	$\frac{3\,k^2\,r_5+2\,t_2}{(1+k^2)^2\,r_5\,t_2}$	0	0	0	0
$\sigma_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	$\frac{1}{k^2\,r_5}$	0	0	0
$\sigma_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	0	0	0
$\tau_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	0	0	0	0
$\tau_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	0	0	0

	$\omega_{1^+}^{\#2\,\alpha\beta}$	$f_{1^+}^{\#1\,\alpha\beta}$	$\omega_{1^-}^{\#1\,\alpha}$	$\omega_{1^-}^{\#2\,\alpha}$	$f_{1^-}^{\#1\,\alpha}$	$f_{1^-}^{\#2\,\alpha}$
$\omega_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	0	0	0	0
$\omega_{1^+}^{\#2\,\alpha\beta}\,\dagger$	$\frac{t_2}{3}$	$\frac{i\,k\,t_2}{3}$	0	0	0	0
$f_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$\frac{i\,k\,t_2}{3}$	$\frac{k^2\,t_2}{3}$	$k^2\,r_5$	0	0	0
$\omega_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	0	0	0	0
$\omega_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	0	0	0
$f_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	0	0	0	0
$f_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	0	0	0

	$\omega_{1^+}^{\#1\,\alpha\beta}$
$\omega_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$k^2\,r_5+\frac{2\,t_2}{3}$
$\omega_{1^+}^{\#2\,\alpha\beta}\,\dagger$	$\frac{\sqrt{2}\,t_2}{3}$
$f_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$
$\omega_{1^-}^{\#1\,\alpha}\,\dagger$	0
$\omega_{1^-}^{\#2\,\alpha}\,\dagger$	0
$f_{1^-}^{\#1\,\alpha}\,\dagger$	0
$f_{1^-}^{\#2\,\alpha}\,\dagger$	0

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\,\dagger$	0	0	0	0
$f_{0^+}^{\#1}\,\dagger$	0	0	0	0
$f_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\,\dagger$	0	0	0	$k^2\,r_2+t_2$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\,\dagger$	0	0	0	0
$\tau_{0^+}^{\#1}\,\dagger$	0	0	0	0
$\tau_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{1}{k^2\,r_2+t_2}$

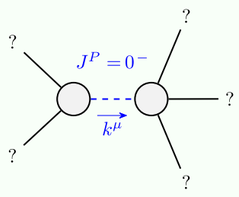
Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\sigma_{0^+}^{\#1} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\;\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	5
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	30

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

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

Massive and massless spectra



Massive particle

Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$-\frac{t_2}{r_2} > 0$
Spin:	0
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_2 < 0 \;\&\&\; t_2 > 0$