Particle spectrograph

Wave operator and propagator

	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\alpha\beta}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\alpha\beta}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\alpha\beta}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\alpha}$	$\frac{2}{k^2 (r_3+2 r_5)}$	$\frac{2\sqrt{2}}{k^2 (1+2k^2)(r_3+2r_5)}$	0	$\frac{4i}{k(1+2k^2)(r_3+2r_5)}$
$\sigma_{1^-}^{\#2}{}^{\alpha}$	$\frac{2\sqrt{2}}{k^2 (1+2k^2)(r_3+2r_5)}$	$\frac{3k^2(r_3+2r_5)+4t_3}{(k+2k^3)^2(r_3+2r_5)t_3}$	0	$\frac{i\sqrt{2}\,(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$
$\tau_{1^-}^{\#1}{}^{\alpha}$	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\alpha}$	$\frac{4i}{k(1+2k^2)(r_3+2r_5)}$	$-\frac{i\sqrt{2}\,(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$	0	$\frac{6k^2(r_3+2r_5)+8t_3}{(1+2k^2)^2(r_3+2r_5)t_3}$

	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\alpha\beta}$	0	0	0	0
$\omega_{1^+}^{\#2}{}^{\alpha\beta}$	0	0	0	0
$f_{1^+}^{\#1}{}^{\alpha\beta}$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\alpha}$	$k^2\left(\frac{r_3}{2}+r_5\right)+\frac{2t_3}{3}$	$-\frac{\sqrt{2}\,t_3}{3}$	0	$-\frac{2}{3}i\,k\,t_3$
$\omega_{1^-}^{\#2}{}^{\alpha}$	$-\frac{\sqrt{2}\,t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}\,k\,t_3$
$f_{1^-}^{\#1}{}^{\alpha}$	0	0	0	0
$f_{1^-}^{\#2}{}^{\alpha}$	$\frac{2ik\,t_3}{3}$	$-\frac{1}{3}i\sqrt{2}\,k\,t_3$	0	$\frac{2k^2 t_3}{3}$

Quadratic (free) action

$$S = \iiint (f^{\alpha\beta}\,\tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - \frac{1}{2} r_3 (\partial_\beta \omega_{\iota\ \theta}^{\ \theta}\,\partial^\prime \omega^{\alpha\beta}_{\ \ \alpha} + \partial_\iota \omega_\beta^{\ \theta}\,\partial^\prime \omega^{\alpha\beta}_{\ \ \alpha} + 8\,\partial_\beta \omega_{\iota\theta\alpha}\,\partial^\theta \omega^{\alpha\beta\iota}) - 2\,\partial^\prime \omega^{\alpha\beta}_{\ \ \alpha}\,\partial_\theta \omega_{\iota\ \beta}^{\ \theta} + 8\,\partial_\beta \omega_{\iota\theta\alpha}\,\partial^\theta \omega^{\alpha\beta\iota}) - 2\,\partial^\prime \omega^{\alpha\beta}_{\ \ \alpha}\,\partial_\theta \omega_{\iota\ \beta}^{\ \theta} + \partial_\alpha \omega^{\alpha\beta\iota}\,\partial_\theta \omega_{\iota\ \beta}^{\ \theta} - 2\,\partial^\prime \omega^{\alpha\beta}_{\ \ \alpha}\,\partial_\theta \omega_{\iota\ \beta}^{\ \theta} + \frac{2}{3} t_3 (\omega^{\alpha\iota}_{\ \ \alpha}\,\omega_{\iota\ \kappa}^{\ \kappa} - 2\,\omega_{\alpha\ \kappa}^{\ \kappa}\,\partial_\iota f^{\alpha\iota} + 2\,\omega_{\iota\ \kappa}^{\ \kappa}\,\partial_\iota f^{\alpha\iota} + \partial_\iota f^{\alpha\iota}\,\partial_\kappa f_\alpha^{\ \kappa}) + 2\,\partial^\prime f^{\alpha\iota}_{\ \ \alpha}\,\partial_\kappa f_\iota^{\ \kappa}) + r_5 (\partial_\iota \omega_\theta^{\ \kappa}\,\partial^\theta \omega^{\alpha\iota}_{\ \ \alpha} - \partial_\theta \omega_{\iota\ \kappa}^{\ \kappa}\,\partial^\theta \omega^{\alpha\iota}_{\ \ \alpha} - (\partial_\alpha \omega^{\alpha\iota\theta} - 2\,\partial^\theta \omega^{\alpha\iota}_{\ \ \alpha})\,(\partial_\kappa \omega_{\iota\ \theta}^{\ \kappa} - \partial_\kappa \omega_{\theta\ \iota}^{\ \kappa}))][t, x, y, z]\,dz\,dy\,dx\,dt$$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\dagger$	$\frac{1}{(1+2k^2)^2 t_3}$	$-\frac{i\sqrt{2}\,k}{(1+2k^2)^2 t_3}$	0	0
$\tau_{0^+}^{\#1}\dagger$	$\frac{i\sqrt{2}\,k}{(1+2k^2)^2 t_3}$	$\frac{2k^2}{(1+2k^2)^2 t_3}$	0	0
$\tau_{0^+}^{\#2}\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\dagger$	0	0	0	0

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

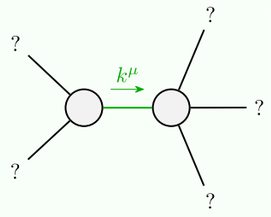
	$\sigma_{2^+}^{\#1}{}^{\alpha\beta}$	$\tau_{2^+}^{\#1}{}^{\alpha\beta}$	$\sigma_{2^-}^{\#1}{}^{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1}{}^{\alpha\beta}\dagger$	$-\frac{2}{3k^2 r_3}$	0	0
$\tau_{2^+}^{\#1}{}^{\alpha\beta}\dagger$	0	0	0
$\sigma_{2^-}^{\#1}{}^{\alpha\beta\chi}\dagger$	0	0	0

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	t_3	$-i\sqrt{2}\,k\,t_3$	0	0
$f_{0^+}^{\#1}\dagger$	$i\sqrt{2}\,k\,t_3$	$2k^2 t_3$	0	0
$f_{0^+}^{\#2}\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\dagger$	0	0	0	0

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^-}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{0^+}^{\#1} - 2\,i\,k\,\sigma_{0^+}^{\#1} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2\,i\,k\,\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} == 0$	3
$\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	25

Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

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