Particle spectrograph

Wave operator and propagator

	$\sigma^{\#1}_{1^+}{}^{\dagger\alpha\beta}$	$\sigma^{\#2}_{1^+}{}^{\dagger\alpha\beta}$	$\tau^{\#1}_{1^+}{}^{\dagger\alpha\beta}$	$\sigma^{\#1}_{1^-}{}^{\dagger\alpha}$	$\sigma^{\#2}_{1^-}{}^{\dagger\alpha}$	$\tau^{\#1}_{1^-}{}^{\dagger\alpha}$	$\tau^{\#2}_{1^-}{}^{\dagger\alpha}$
$\tau^{\#2}_{1^-\,\alpha}$	0	0	0	$-\frac{i}{k(1+2k^2)(2r_3+r_5)}$	$\frac{i(6k^2(2r_3+r_5)+t_1)}{\sqrt{2}\,k(1+2k^2)^2(2r_3+r_5)t_1}$	0	$\frac{6k^2(2r_3+r_5)+t_1}{(1+2k^2)^2(2r_3+r_5)t_1}$
$\tau^{\#1}_{1^-\,\alpha}$	0	0	0	0	0	0	0
$\sigma^{\#2}_{1^-\,\alpha}$	0	0	0	$-\frac{1}{\sqrt{2}(k^2+2k^4)(2r_3+r_5)}$	$\frac{6k^2(2r_3+r_5)+t_1}{2(k+2k^3)^2(2r_3+r_5)t_1}$	0	$-\frac{i(6k^2(2r_3+r_5)+t_1)}{\sqrt{2}\,k(1+2k^2)^2(2r_3+r_5)t_1}$
$\sigma^{\#1}_{1^-\,\alpha}$	0	0	0	$\frac{1}{k^2(2r_3+r_5)}$	$-\frac{1}{\sqrt{2}(k^2+2k^4)(2r_3+r_5)}$	0	$\frac{i}{k(1+2k^2)(2r_3+r_5)}$
$\tau^{\#1}_{1^+\,\alpha\beta}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2t_1}$	$\frac{-2ik^3(2r_3+r_5)+ikt_1}{(1+k^2)^2t_1^2}$	$\frac{-2k^4(2r_3+r_5)+k^2t_1}{(1+k^2)^2t_1^2}$	0	0	0	0
$\sigma^{\#2}_{1^+\,\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$\frac{-2k^2(2r_3+r_5)+t_1}{(1+k^2)^2t_1^2}$	$\frac{i(2k^3(2r_3+r_5)-kt_1)}{(1+k^2)^2t_1^2}$	0	0	0	0
$\sigma^{\#1}_{1^+\,\alpha\beta}$	0	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$\frac{i\sqrt{2}\,k}{t_1+k^2t_1}$	0	0	0	0

	$\sigma^{\#1}_{2^+\,\alpha\beta}$	$\tau^{\#1}_{2^+\,\alpha\beta}$	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}{}^{\dagger\alpha\beta}$	$\frac{2}{(1+2k^2)^2t_1}$	$-\frac{2i\sqrt{2}\,k}{(1+2k^2)^2t_1}$	0
$\tau^{\#1}_{2^+}{}^{\dagger\alpha\beta}$	$\frac{2i\sqrt{2}\,k}{(1+2k^2)^2t_1}$	$\frac{4k^2}{(1+2k^2)^2t_1}$	0
$\sigma^{\#1}_{2^-}{}^{\dagger\alpha\beta\chi}$	0	0	$\frac{2}{t_1}$

	$\omega^{\#1}_{2^+}{}^{\dagger\alpha\beta}$	$f^{\#1}_{2^+}{}^{\dagger\alpha\beta}$	$\omega^{\#1}_{2^-}{}^{\dagger\alpha\beta\chi}$
$\omega^{\#1}_{2^-\,\alpha\beta\chi}$	0	0	$\frac{t_1}{2}$
$f^{\#1}_{2^+\,\alpha\beta}$	$-\frac{ikt_1}{\sqrt{2}}$	k^2t_1	0
$\omega^{\#1}_{2^+\,\alpha\beta}$	$\frac{t_1}{2}$	$\frac{ikt_1}{\sqrt{2}}$	0

	$\sigma^{\#1}_{0^+}{}^{\dagger}$	$\tau^{\#1}_{0^+}{}^{\dagger}$	$\tau^{\#2}_{0^+}{}^{\dagger}$	$\sigma^{\#1}_{0^-}{}^{\dagger}$
$\sigma^{\#1}_{0^-}$	0	0	0	$-\frac{1}{t_1}$
$\tau^{\#2}_{0^+}$	0	0	0	0
$\tau^{\#1}_{0^+}$	0	0	0	0
$\sigma^{\#1}_{0^+}$	$\frac{1}{6k^2r_3}$	0	0	0

	$\omega^{\#1}_{1^+}{}^{\dagger\alpha\beta}$	$\omega^{\#2}_{1^+}{}^{\dagger\alpha\beta}$	$f^{\#1}_{1^+}{}^{\dagger\alpha\beta}$	$\omega^{\#1}_{1^-}{}^{\dagger\alpha}$	$\omega^{\#2}_{1^-}{}^{\dagger\alpha}$	$f^{\#1}_{1^-}{}^{\dagger\alpha}$	$f^{\#2}_{1^-}{}^{\dagger\alpha}$
$f^{\#2}_{1^-\,\alpha}$	0	0	0	$\frac{ikt_1}{3}$	$\frac{1}{3}i\sqrt{2}\,kt_1$	0	$\frac{2k^2t_1}{3}$
$f^{\#1}_{1^-\,\alpha}$	0	0	0	0	0	0	0
$\omega^{\#2}_{1^-\,\alpha}$	0	0	0	$\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	0	$-\frac{1}{3}i\sqrt{2}\,kt_1$
$\omega^{\#1}_{1^-\,\alpha}$	0	0	0	$k^2(2r_3+r_5)+\frac{t_1}{6}$	$\frac{t_1}{3\sqrt{2}}$	0	$-\frac{1}{3}ikt_1$
$f^{\#1}_{1^+\,\alpha\beta}$	$-\frac{ikt_1}{\sqrt{2}}$	0	0	0	0	0	0
$\omega^{\#2}_{1^+\,\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\omega^{\#1}_{1^+\,\alpha\beta}$	$k^2(2r_3+r_5)-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$\frac{ikt_1}{\sqrt{2}}$	0	0	0	0

Quadratic (free) action

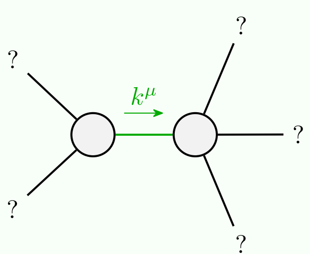
$$S == \iiiint (f^{\alpha\beta}\tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi} + \tfrac{1}{6}t_1(2\,\omega^{\alpha\iota}{}_{\alpha}\,\omega_{\iota}{}^{\theta}{}_{\theta} - 4\,\omega_{\alpha}{}^{\theta}{}_{\theta}\,\partial_{\iota}f^{\alpha\iota} + 4\,\omega_{\iota}{}^{\theta}{}_{\theta}\,\partial^{\iota}f^{\alpha}{}_{\alpha} - 2\,\partial_{\iota}f^{\theta}{}_{\theta}\,\partial^{\iota}f^{\alpha}{}_{\alpha} - 2\,\partial_{\iota}f^{\alpha\iota}\,\partial_{\theta}f^{\theta}{}_{\alpha} + 4\,\partial^{\iota}f^{\alpha}{}_{\alpha}\,\partial_{\theta}f^{\theta}{}_{\iota} - 6\,\partial_{\alpha}f_{\iota\theta}\,\partial^{\theta}f^{\alpha\iota} - 3\,\partial_{\alpha}f_{\theta\iota}\,\partial^{\theta}f^{\alpha\iota} + 3\,\partial_{\iota}f_{\alpha\theta}\,\partial^{\theta}f^{\alpha\iota} + 3\,\partial_{\theta}f_{\alpha\iota}\,\partial^{\theta}f^{\alpha\iota} + 3\,\partial_{\theta}f_{\iota\alpha}\,\partial^{\theta}f^{\alpha\iota} + 6\,\omega_{\alpha\theta\iota}\,(\omega^{\alpha\iota\theta} + 2\,\partial^{\theta}f^{\alpha\iota})) - 2\,r_3\,(\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\iota}{}^{\theta} - 2\,\partial^{\iota}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\theta}\omega_{\beta\iota}{}^{\theta} + \partial_{\alpha}\omega^{\alpha\beta\iota}\,\partial_{\theta}\omega_{\iota\beta}{}^{\theta} - 2\,\partial^{\iota}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\theta}\omega_{\iota\beta}{}^{\theta} + 2\,\partial_{\beta}\omega_{\iota\theta\alpha}\,\partial^{\theta}\omega^{\alpha\beta\iota}) + r_5\,(\partial_{\iota}\omega_{\theta}{}^{\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})))[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\omega^{\#1}_{0^+}{}^{\dagger}$	$f^{\#1}_{0^+}{}^{\dagger}$	$f^{\#2}_{0^+}{}^{\dagger}$	$\omega^{\#1}_{0^-}{}^{\dagger}$
$\omega^{\#1}_{0^-}$	0	0	0	$-t_1$
$f^{\#2}_{0^+}$	0	0	0	0
$f^{\#1}_{0^+}$	0	0	0	0
$\omega^{\#1}_{0^+}$	$6k^2r_3$	0	0	0

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau^{\#2}_{0^+} == 0$	1
$\tau^{\#1}_{0^+} == 0$	1
$\tau^{\#2\,\alpha}_{1^-} + 2\,i\,k\,\sigma^{\#2\,\alpha}_{1^-} == 0$	3
$\tau^{\#1\,\alpha}_{1^-} == 0$	3
$\tau^{\#1\,\alpha\beta}_{1^+} + i\,k\,\sigma^{\#2\,\alpha\beta}_{1^+} == 0$	3
$\tau^{\#1\,\alpha\beta}_{2^+} - 2\,i\,k\,\sigma^{\#1\,\alpha\beta}_{2^+} == 0$	5
Total constraints:	16

Massive and massless spectra



Quadratic pole	
Pole residue:	$-\frac{1}{(2r_3+r_5)t_1^2} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$r_5 < -2\,r_3\ \&\&\ t_1 < 0\ ||\ t_1 > 0$