Particle spectrograph

Wave operator and propagator

	$\omega^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#2}_{1^+\,\alpha\beta}$	$f^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#1}_{1^-\,\alpha}$	$\omega^{\#2}_{1^-\,\alpha}$	$f^{\#1}_{1^-\,\alpha}$	$f^{\#2}_{1^-\,\alpha}$
$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{6}(6k^2r_5+t_1+4t_2)$	$-\frac{t_1-2t_2}{3\sqrt{2}}$	$-\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	0	0	0	0
$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	$-\frac{t_1-2t_2}{3\sqrt{2}}$	$\frac{t_1+t_2}{3}$	$\frac{1}{3}ik(t_1+t_2)$	0	0	0	0
$f^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	$-\frac{1}{3}ik(t_1+t_2)$	$\frac{1}{3}k^2(t_1+t_2)$	0	0	0	0
$\omega^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	$k^2r_5-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	ikt_1
$\omega^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$f^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-ikt_1$	0	0	0

	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	0
$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	$\frac{2}{t_1}$

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

	$\sigma^{\#1}_{0^+}$	$\tau^{\#1}_{0^+}$	$\tau^{\#2}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	$-\frac{1}{(1+2k^2)^2t_1}$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	0	0
$\tau^{\#1}_{0^+}\dagger$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	$-\frac{2k^2}{(1+2k^2)^2t_1}$	0	0
$\tau^{\#2}_{0^+}\dagger$	0	0	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	0	0	$\frac{1}{t_2}$

	$\omega^{\#1}_{0^+}$	$f^{\#1}_{0^+}$	$f^{\#2}_{0^+}$	$\omega^{\#1}_{0^-}$
$\omega^{\#1}_{0^+}\dagger$	$-t_1$	$i\sqrt{2}kt_1$	0	0
$f^{\#1}_{0^+}\dagger$	$-i\sqrt{2}kt_1$	$-2k^2t_1$	0	0
$f^{\#2}_{0^+}\dagger$	0	0	0	0
$\omega^{\#1}_{0^-}\dagger$	0	0	0	t_2

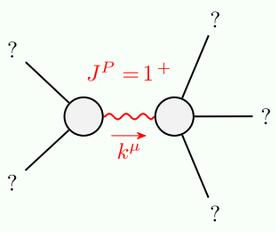
Quadratic (free) action

$$S_F == \iiint\Big(\frac{1}{6}(-6t_1\,\omega_{\iota}^{\alpha\prime}\,\omega_{\kappa\alpha}^{\ \kappa} - 2(t_1-2t_2)\,\omega_{\iota}^{\ \kappa\lambda}\,\omega_{\kappa\lambda}^{\ \prime} + 2t_1\,\omega_{\kappa\lambda}^{\ \prime}\,\omega^{\kappa\lambda}{}_{\iota} + 2t_2\,\omega_{\kappa\lambda}^{\ \prime}\,\omega^{\kappa\lambda}{}_{\iota} + 6f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 6r_5\,\partial_\iota\omega^{\kappa\lambda}\,\partial^\iota\omega_{\lambda\ \alpha}^{\ \alpha} - 6r_5\,\partial_\alpha\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_\kappa\omega^{\theta\kappa\lambda} + 6r_5\,\partial_\theta\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_\kappa\omega^{\kappa\lambda\theta} - 2t_1\,\partial^\alpha f_{\theta\kappa}\,\partial^\kappa f_\alpha^{\ \theta} + t_2\,\partial^\alpha f_{\theta\kappa}\,\partial^\kappa f_\alpha^{\ \theta} - 4t_1\,\partial^\alpha f_{\kappa\theta}\,\partial^\kappa f_\alpha^{\ \theta} - 2t_1\,\partial^\alpha f^\lambda{}_\kappa\,\partial^\kappa f_{\alpha\lambda} + t_2\,\partial^\alpha f^\lambda{}_\kappa\,\partial^\kappa f_{\alpha\lambda} + 6t_1\,\omega_{\kappa\alpha}^{\ \alpha}\,\partial^\kappa f^\prime{}_\iota + 6t_1\,\omega_{\kappa\lambda}^{\ \lambda}\,\partial^\kappa f^\prime{}_\iota + 12t_1\,\partial^\alpha f_{\kappa\alpha}\,\partial^\kappa f^\prime{}_\iota - 6t_1\,\partial_\kappa f^\lambda{}_\lambda\,\partial^\kappa f^\prime{}_\iota + 2t_1\,\omega_{\iota\theta\kappa}\,\partial^\kappa f^{\prime\iota\theta} + 2t_1\,\omega_{\iota\theta\kappa}\,\partial^\kappa f^{\prime\iota\theta} + 8t_1\,\omega_{\iota\kappa\theta}\,\partial^\kappa f^{\prime\iota\theta} - 4t_2\,\omega_{\iota\kappa\theta}\,\partial^\kappa f^{\prime\iota\theta} - 2t_1\,\omega_{\theta\iota\kappa}\,\partial^\kappa f^{\prime\iota\theta} + 4t_1\,\omega_{\theta\kappa\iota}\,\partial^\kappa f^{\prime\iota\theta} + 4t_2\,\omega_{\theta\kappa\iota}\,\partial^\kappa f^{\prime\iota\theta} - 6t_1\,\omega_{\iota\alpha}^{\ \alpha}\,\partial^\kappa f^\prime{}_\kappa - 6t_1\,\omega_{\iota\lambda}^{\ \lambda}\,\partial^\kappa f^\prime{}_\kappa + 2t_1\,\partial^\alpha f^\lambda{}_\kappa\,\partial^\kappa f_{\lambda\alpha} - t_2\,\partial^\alpha f^\lambda{}_\kappa\,\partial^\kappa f_{\lambda\alpha} + 2t_1\,\partial_\kappa f^\lambda{}_\theta\,\partial^\kappa f_\lambda^{\ \theta} - 6t_1\,\partial^\alpha f_\lambda^{\ \theta}\,\partial^\kappa f_\theta^{\ \lambda} + 4t_1\,\partial_\kappa f^\lambda{}_\theta\,\partial^\kappa f_\lambda^{\ \theta} + t_2\,\partial_\kappa f^\lambda{}_\theta\,\partial^\kappa f_\lambda^{\ \theta} - 6t_1\,\partial^\alpha f_\lambda^{\ \theta}\,\partial^\kappa f_\theta^{\ \lambda} + 6r_5\,\partial_\alpha\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^\lambda\omega^{\theta\kappa} - 6r_5\,\partial_\theta\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial^\lambda\omega^{\theta\kappa})\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

Source constraints/gauge generators

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

Massive and massless spectra



Massive particle

Pole residue:	$\frac{-3t_1t_2(t_1+t_2)+3r_5(t_1^2+2t_2^2)}{r_5(t_1+t_2)(-3t_1t_2+2r_5(t_1+t_2))} > 0$
Polarisations:	3
Square mass:	$-\frac{3t_1t_2}{2r_5t_1+2r_5t_2} > 0$
Spin:	1
Parity:	Even

(No massless particles)

Unitarity conditions

$$r_5 > 0 \;\&\&\; (t_1 < 0 \;\&\&\; (t_2 < 0 \,||\, t_2 > -t_1)) \,||\, (t_1 > 0 \;\&\&\; -t_1 < t_2 < 0)$$