Particle spectrograph

Wave operator and propagator

	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\frac{1}{k^2 (r_1+r_5)}$	$\frac{\sqrt{2}}{k^2 (1+2k^2)(r_1+r_5)}$	0	$\frac{2i}{k(1+2k^2)(r_1+r_5)}$
$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	0	$\frac{3k^2(r_1+r_5)+2t_3}{(k+2k^3)^2(r_1+r_5)t_3}$	0	$\frac{i\sqrt{2}(3k^2(r_1+r_5)+2t_3)}{k(1+2k^2)^2(r_1+r_5)t_3}$
$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}_{\alpha}$	0	$\frac{\sqrt{2}}{k^2 (1+2k^2)(r_1+r_5)}$	0	$\frac{2i}{k(1+2k^2)(r_1+r_5)}$
$\sigma_{1^-}^{\#2}{}_{\alpha}$	0	$\frac{3k^2(r_1+r_5)+2t_3}{(k+2k^3)^2(r_1+r_5)t_3}$	0	$\frac{i\sqrt{2}(3k^2(r_1+r_5)+2t_3)}{k(1+2k^2)^2(r_1+r_5)t_3}$
$\tau_{1^-}^{\#1}{}_{\alpha}$	0	0	0	0
$\tau_{1^-}^{\#2}{}_{\alpha}$	0	0	0	$\frac{6k^2(r_1+r_5)+4t_3}{(1+2k^2)^2(r_1+r_5)t_3}$

	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	0	0	0	0
$f_{1^+}^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\omega_{1^-}^{\#1}{}_{\alpha}$	$k^2 (r_1+r_5)+\frac{2t_3}{3}$	$-\frac{\sqrt{2}t_3}{3}$	0	$-\frac{2}{3}ikt_3$
$\omega_{1^-}^{\#2}{}_{\alpha}$	$-\frac{\sqrt{2}t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}kt_3$
$f_{1^-}^{\#1}{}_{\alpha}$	0	0	0	0
$f_{1^-}^{\#2}{}_{\alpha}$	$\frac{2ikt_3}{3}$	$-\frac{1}{3}i\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$

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

Quadratic (free) action

$$S == \iiint\int (\tfrac{1}{3}(-2t_3\,\omega^{\alpha\prime}{}_{\alpha}\,\omega_{\prime}{}^{\kappa}{}_{\kappa} + 3\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 3\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + 4t_3\,\omega_{\alpha}{}^{\kappa}{}_{\kappa}\,\partial_{\prime}f^{\alpha\prime} - 4t_3\,\omega_{\prime}{}^{\kappa}$$
$$\partial^{\prime}f^{\alpha}{}_{\alpha} + 2t_3\,\partial_{\prime}f^{\kappa}{}_{\kappa}\,\partial^{\prime}f^{\alpha}{}_{\alpha} - 4r_1\,\partial_{\beta}\omega_{\alpha\prime\theta}\,\partial^{\theta}\omega^{\alpha\beta\prime} -$$
$$8r_1\,\partial_{\beta}\omega_{\prime\theta\alpha}\,\partial^{\theta}\omega^{\alpha\beta\prime} - 2r_1\,\partial_{\prime}\omega_{\alpha\beta\theta}\,\partial^{\theta}\omega^{\alpha\beta\prime} +$$
$$2r_1\,\partial_{\theta}\omega_{\alpha\prime\beta}\,\partial^{\theta}\omega^{\alpha\beta\prime} + 3r_5\,\partial_{\prime}\omega_{\theta}{}^{\kappa}\,\partial^{\theta}\omega^{\alpha\prime}{}_{\kappa}\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha} +$$
$$2t_3\,\partial_{\prime}f^{\alpha\prime}\,\partial_{\kappa}f^{\kappa}{}_{\alpha} - 4t_3\,\partial^{\prime}f^{\alpha}{}_{\alpha}\,\partial_{\kappa}f^{\kappa}{}_{\prime} - 3r_5\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa}{}_{\theta}{}^{\prime} +$$
$$3r_5\,\partial_{\alpha}\omega^{\alpha\prime\theta}\,\partial_{\kappa}\omega^{\kappa}{}_{\theta}{}^{\prime} - 6r_5\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa}{}_{\theta}{}^{\prime}))[t,x,y,z]\,dz\,dy\,dx\,dt$$

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

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

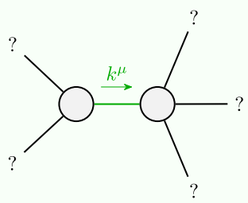
	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}\dagger^{\alpha\beta}$	0	0	0
$f_{2^+}^{\#1}\dagger^{\alpha\beta}$	0	0	0
$\omega_{2^-}^{\#1}\dagger^{\alpha\beta\chi}$	0	0	$k^2 r_1$

Source constraints/gauge generators

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

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	t_3	$-i\sqrt{2}\,kt_3$	0	0
$f_{0^+}^{\#1}\dagger$	$i\sqrt{2}\,kt_3$	$2k^2 t_3$	0	0
$f_{0^+}^{\#2}\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\dagger$	0	0	0	0

Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

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