Particle spectrograph

Wave operator and propagator

	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$-\frac{i\sqrt{2}}{k r_5+k^3 r_5}$	$-\frac{\sqrt{2}}{k^2 r_5+k^4 r_5}$	$\frac{i(3k^2 r_5+2t_2)}{k(1+k^2)^2 r_5 t_2}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\dagger}{}^{\alpha\beta}$	$-\frac{\sqrt{2}}{k^2 r_5+k^4 r_5}$	$\frac{3k^2 r_5+2t_2}{(k+k^3)^2 r_5 t_2}$	$-\frac{i(3k^2 r_5+2t_2)}{k(1+k^2)^2 r_5 t_2}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$\frac{i\sqrt{2}}{k r_5+k^3 r_5}$	$\frac{\sqrt{2}}{k^2 r_5+k^4 r_5}$	$-\frac{3k^2 r_5+2t_2}{(k+k^3)^2 r_5 t_2}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	0	0	$\frac{1}{k^2 r_5}$	$\frac{\sqrt{2}}{k^2 r_5+2k^4 r_5}$	$\frac{i\sqrt{2}}{k r_5+2k^3 r_5}$	$\frac{2i}{k r_5+2k^3 r_5}$
$\sigma_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	0	0	$\frac{\sqrt{2}}{k^2 r_5+2k^4 r_5}$	$\frac{3k^2 r_5+2t_3}{(k+2k^3)^2 r_5 t_3}$	$\frac{i\sqrt{2}(3k^2 r_5+2t_3)}{k(1+2k^2)^2 r_5 t_3}$	0
$\tau_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	0	0	$-\frac{2i}{k r_5+2k^3 r_5}$	$-\frac{i\sqrt{2}(3k^2 r_5+2t_3)}{k(1+2k^2)^2 r_5 t_3}$	0	$\frac{6k^2 r_5+4t_3}{(1+2k^2)^2 r_5 t_3}$

Quadratic (free) Lagrangian density

$$\frac{2}{3}t_3\,\omega_{\prime}^{\alpha\prime}\,\omega_{\kappa\alpha}{}^{\kappa}+\frac{2}{3}t_2\,\omega_{\prime}{}^{\kappa\lambda}\,\omega_{\kappa\lambda}{}^{\prime}+\frac{1}{3}t_2\,\omega_{\kappa\lambda}{}^{\prime}\,\omega^{\kappa\lambda}{}_{\prime}+f^{\alpha\beta}\,\tau_{\alpha\beta}+$$
$$\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-r_5\,\partial_{\prime}\omega^{\kappa\lambda}{}_{\kappa}\,\partial^{\prime}\omega^{\alpha}{}_{\lambda\,\alpha}+\frac{2}{3}r_2\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}-\frac{1}{3}r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta}-$$
$$\frac{2}{3}r_2\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta}-r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+$$
$$2\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+\frac{1}{6}t_2\,\partial^{\alpha}f_{\theta\kappa}\,\partial^{\kappa}f_{\ \alpha}^{\theta}-\frac{1}{6}t_2\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\ \alpha}^{\theta}+\frac{1}{6}t_2\,\partial^{\alpha}f^{\kappa\lambda}\,\partial^{\kappa}f_{\alpha\lambda}-$$
$$\frac{2}{3}t_3\,\omega_{\kappa\alpha}{}^{\alpha}\,\partial^{\kappa}f_{\ \prime}^{\prime}-\frac{2}{3}t_3\,\omega_{\kappa\lambda}{}^{\lambda}\,\partial^{\kappa}f_{\ \prime}^{\prime}-\frac{4}{3}t_3\,\partial_{\kappa}f^{\kappa\lambda}{}_{\lambda}\,\partial^{\kappa}f_{\ \prime}^{\prime}+$$
$$\frac{1}{3}t_2\,\omega_{\prime\theta\kappa}\,\partial^{\kappa}f^{\prime\theta}+\frac{2}{3}t_2\,\omega_{\theta\kappa\prime}\,\partial^{\kappa}f^{\prime\theta}-\frac{2}{3}t_2\,\omega_{\prime\kappa\theta}\,\partial^{\kappa}f^{\prime\theta}-\frac{1}{3}t_2\,\omega_{\theta\prime\kappa}\,\partial^{\kappa}f^{\prime\theta}+$$
$$\frac{2}{3}t_3\,\omega_{\prime\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{2}{3}t_3\,\omega_{\prime\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\kappa}-\frac{1}{6}t_2\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda}^{\ \theta}+$$
$$\frac{1}{6}t_2\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda}^{\ \theta}+\frac{2}{3}t_3\,\partial^{\alpha}f^{\lambda}{}_{\alpha}\,\partial^{\kappa}f_{\lambda\kappa}+\frac{1}{3}r_2\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}+\frac{2}{3}r_2\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}-$$
$$\frac{2}{3}r_2\,\partial^{\beta}\omega_{\prime}^{\alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime}+r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}-r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}$$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$k^2 r_5+\frac{2t_2}{3}$	$\frac{\sqrt{2}\,t_2}{3}$	$-\frac{1}{3}i\sqrt{2}\,k t_2$	$k^2 r_5+\frac{2t_3}{3}$	$-\frac{\sqrt{2}\,t_3}{3}$	0	$-\frac{2}{3}i\,k t_3$
$\omega_{1^+}^{\#2}{}^{\dagger}{}^{\alpha\beta}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{t_2}{3}$	$\frac{i k t_2}{3}$	$-\frac{\sqrt{2}\,t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}\,k t_3$
$f_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$\frac{1}{3}i\sqrt{2}\,k t_2$	$\frac{i k t_2}{3}$	$\frac{k^2 t_2}{3}$	$\frac{2ik t_3}{3}$	$-\frac{1}{3}i\sqrt{2}\,k t_3$	0	$\frac{2k^2 t_3}{3}$
$\omega_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	0	0	0	0	0	0
$\omega_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	0	0	0	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	$k^2 r_2+t_2$

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

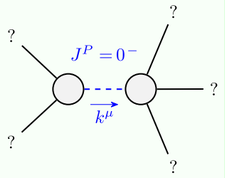
	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	0	0	0
$f_{2^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	0	0	0
$\omega_{2^-}^{\#1}{}^{\dagger}{}^{\alpha\beta\chi}$	0	0	0

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2}==0$	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
$\tau_{1^+}^{\#1\alpha\beta}+i\,k\,\sigma_{1^+}^{\#2\alpha\beta}==0$	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:	26

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	$\frac{1}{(1+2k^2)^2 t_3}$	$-\frac{i\sqrt{2}\,k}{(1+2k^2)^2 t_3}$	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	$\frac{1}{k^2 r_2+t_2}$

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

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