Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{1}{k^2\,(2\,r_3+r_5)}$	$-\frac{\sqrt{2}}{k^2\,(1+k^2)\,(2\,r_3+r_5)}$	$-\frac{i\,\sqrt{2}}{k\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{2}{k^2\,(r_3+2\,r_5)}$	$\frac{2\,\sqrt{2}}{k^2\,(1+2\,k^2)\,(r_3+2\,r_5)}$	0	$\frac{4\,i}{k\,(1+2\,k^2)\,(r_3+2\,r_5)}$
$\sigma_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$-\frac{\sqrt{2}}{k^2\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{(k+k^3)^2\,(2\,r_3+r_5)\,t_2}$	$-\frac{i\,(3\,k^2\,(2\,r_3+r_5)+2\,t_2)}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{i\,\sqrt{2}}{k\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{i\,(3\,k^2\,(2\,r_3+r_5)+2\,t_2)}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	$\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	$\frac{2}{k^2\,(r_3+2\,r_5)}$	$\frac{2\,\sqrt{2}}{k^2\,(1+2\,k^2)\,(r_3+2\,r_5)}$	0	$-\frac{4\,i}{k\,(1+2\,k^2)\,(r_3+2\,r_5)}$
$\sigma_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$\frac{2\,\sqrt{2}}{k^2\,(1+2\,k^2)\,(r_3+2\,r_5)}$	$\frac{3\,k^2\,(r_3+2\,r_5)+4\,t_3}{(k+2\,k^3)^2\,(r_3+2\,r_5)\,t_3}$	0	$-\frac{i\,\sqrt{2}\,(3\,k^2\,(r_3+2\,r_5)+4\,t_3)}{k\,(1+2\,k^2)^2\,(r_3+2\,r_5)\,t_3}$
$\tau_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$-\frac{4\,i}{k\,(1+2\,k^2)\,(r_3+2\,r_5)}$	$\frac{6\,k^2\,(r_3+2\,r_5)+8\,t_3}{(1+2\,k^2)^2\,(r_3+2\,r_5)\,t_3}$	0	$\frac{4\,i}{k\,(1+2\,k^2)\,(r_3+2\,r_5)}$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$k^2\,(2\,r_3+r_5)+\frac{2\,t_2}{3}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	0	0	0	0
$\omega_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{t_2}{3}$	$\frac{i\,k\,t_2}{3}$	0	0	0	0
$f_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	$-\frac{1}{3}\,i\,k\,t_2$	$\frac{k^2\,t_2}{3}$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	$k^2\,(\frac{r_3}{2}+r_5)+\frac{2\,t_3}{3}$	$-\frac{\sqrt{2}\,t_3}{3}$	0	$-\frac{2}{3}\,i\,k\,t_3$
$\omega_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$-\frac{\sqrt{2}\,t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}\,i\,\sqrt{2}\,k\,t_3$
$f_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$\frac{2\,i\,k\,t_3}{3}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_3$	0	$\frac{2\,k^2\,t_3}{3}$

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

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

Quadratic (free) action

$$S_F == \iiint (\tfrac{1}{6}\,(4\,t_3\,\omega_{\iota}^{\alpha\prime}\,\omega_{\kappa\alpha}^{\ \ \kappa}+4\,t_2\,\omega_{\iota}^{\ \kappa}\,\omega_{\kappa\lambda}^{\ \ \prime}+4\,t_2\,\omega_{\kappa\lambda}^{\ \ \prime}\,\omega_{\iota}^{\ \kappa\lambda}+2\,t_2\,\omega_{\kappa\lambda}^{\ \ \prime}\,\omega_{\iota}^{\ \kappa\lambda}+6\,f^{\alpha\beta}\,\tau_{\alpha\beta}+6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-3\,r_3\,\partial_{\iota}\omega^{\kappa\lambda}\,\partial_{\kappa}\omega_{\lambda\ \alpha}^{\ \alpha}-6\,r_5\,\partial_{\iota}\omega^{\kappa\lambda}\,\partial_{\kappa}\omega_{\lambda\ \alpha}^{\ \alpha}+3\,r_3\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}-3\,r_3\,\partial_{\alpha}\omega_{\lambda\ \alpha}^{\ \alpha}+6\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+12\,r_5\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+6\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}-3\,r_3\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+6\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+6\,r_3\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}+t_2\,\partial^{\alpha}f_{\theta\kappa}\,\partial^{\kappa}f_{\alpha}^{\ \theta}-t_2\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\alpha}^{\ \theta}+t_2\,\partial^{\alpha}f^{\kappa\ \theta}_{\ \alpha}\,\partial^{\kappa}f_{\kappa}^{\ \lambda}+t_2\,\partial^{\alpha}f^{\kappa\lambda}\,\partial^{\kappa}f_{\kappa\alpha}+4\,t_3\,\omega_{\kappa\lambda}^{\ \ \lambda}\,\partial^{\kappa}f^{\prime}_{\iota}-8\,t_3\,\partial^{\alpha}f_{\kappa\alpha}\,\partial^{\kappa}f^{\prime}_{\iota}+4\,t_3\,\partial_{\kappa}f^{\lambda}_{\ \lambda}\,\partial^{\kappa}f^{\prime\theta}+4\,t_2\,\omega_{\iota\kappa\theta}\,\partial^{\kappa}f^{\prime\theta}-2\,t_2\,\omega_{\theta\iota\kappa}\,\partial^{\kappa}f^{\prime\theta}+4\,t_2\,\omega_{\theta\kappa\prime}\,\partial^{\kappa}f^{\prime}_{\ \kappa}+4\,t_3\,\omega_{\prime\lambda}^{\ \ \lambda}\,\partial^{\kappa}f^{\prime}_{\ \kappa}-t_2\,\partial^{\alpha}f^{\lambda}_{\ \kappa}\,\partial^{\kappa}f_{\lambda\alpha}-t_2\,\partial_{\kappa}f^{\ \lambda}_{\theta}\,\partial^{\kappa}f_{\lambda}^{\ \theta}+4\,t_3\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}_{\ \ \kappa}+6\,r_5\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}_{\ \ \kappa})[t,x,y,z]\,d\prime z\,d\prime y\,d\prime x\,d\prime t$$

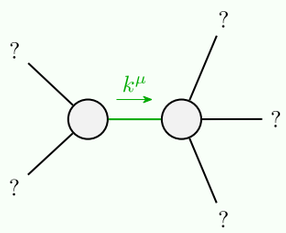
Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2} == 0$	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
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	21

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	t_3	$-i\,\sqrt{2}\,k\,t_3$	0	0
$f_{0^+}^{\#1}{}^{\dagger}$	$i\,\sqrt{2}\,k\,t_3$	$2\,k^2\,t_3$	0	0
$f_{0^+}^{\#2}{}^{\dagger}$	0	0	0	0
$\omega_{0^-}^{\#1}{}^{\dagger}$	0	0	0	t_2

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

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

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