Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\alpha\beta}$	$\frac{2(t_1+t_2)}{3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2)}$	$\frac{\sqrt{2}(t_1-2t_2)}{(1+k^2)(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	$\frac{i\sqrt{2}k(t_1-2t_2)}{(1+k^2)(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\alpha\beta}$	$\frac{\sqrt{2}(t_1-2t_2)}{(1+k^2)(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	$\frac{6k^2(2r_1+r_5)+t_1+4t_2}{(1+k^2)^2(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	$\frac{ik(6k^2(2r_1+r_5)+t_1+4t_2)}{(1+k^2)^2(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\alpha\beta}$	$-\frac{i\sqrt{2}k(t_1-2t_2)}{(1+k^2)(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	$-\frac{ik(6k^2(2r_1+r_5)+t_1+4t_2)}{(1+k^2)^2(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	$\frac{k^2(6k^2(2r_1+r_5)+t_1+4t_2)}{(1+k^2)^2(3t_1t_2+2k^2(2r_1+r_5)(t_1+t_2))}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\alpha}$	0	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2t_1}$	0	$\frac{2ik}{t_1+2k^2t_1}$
$\sigma_{1^-}^{\#2}{}^{\alpha}$	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2t_1}$	$\frac{-2k^2(r_1+r_5)+t_1}{(t_1+2k^2t_1)^2}$	0	$-\frac{i\sqrt{2}k(2k^2(r_1+r_5)-t_1)}{(t_1+2k^2t_1)^2}$
$\tau_{1^-}^{\#1}{}^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\alpha}$	0	0	0	$-\frac{2ik}{t_1+2k^2t_1}$	$\frac{i\sqrt{2}k(2k^2(r_1+r_5)-t_1)}{(t_1+2k^2t_1)^2}$	0	$\frac{-4k^4(r_1+r_5)+2k^2t_1}{(t_1+2k^2t_1)^2}$

	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$
$\omega_{2^+}^{\#1}{}^{\alpha\beta}$	0	0	$\frac{t_1}{2}$
$f_{2^+}^{\#1}{}^{\alpha\beta}$	0	k^2t_1	$-\frac{ikt_1}{\sqrt{2}}$
$\omega_{2^-}^{\#1}{}^{\alpha\beta\chi}$	$k^2r_1+\frac{t_1}{2}$	0	0

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	$-t_1$	$i\sqrt{2}kt_1$	0	0
$f_{0^+}^{\#1}\dagger$	$-i\sqrt{2}kt_1$	$-2k^2t_1$	0	0
$f_{0^+}^{\#2}\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\dagger$	0	0	0	t_2

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

	$\sigma_{2^-}^{\#1}{}_{\alpha\beta\chi}$	$\tau_{2^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{2^+}^{\#1}{}_{\alpha\beta}$
$\sigma_{2^+}^{\#1}{}^{\alpha\beta}$	0	$-\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$	$\frac{2}{(1+2k^2)^2t_1}$
$\tau_{2^+}^{\#1}{}^{\alpha\beta}$	0	$\frac{4k^2}{(1+2k^2)^2t_1}$	$\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$
$\sigma_{2^-}^{\#1}{}^{\alpha\beta\chi}$	$\frac{2}{2k^2r_1+t_1}$	0	0

	$\sigma_{0^-}^{\#1}$	$\tau_{0^+}^{\#2}$	$\tau_{0^+}^{\#1}$	$\sigma_{0^+}^{\#1}$
$\sigma_{0^+}^{\#1}\dagger$	0	0	0	$\frac{1}{t_2}$
$\tau_{0^+}^{\#2}\dagger$	0	0	0	0
$\tau_{0^+}^{\#1}\dagger$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	$-\frac{2k^2}{(1+2k^2)^2t_1}$	0	0
$\sigma_{0^+}^{\#1}\dagger$	$-\frac{1}{(1+2k^2)^2t_1}$	$\frac{ik\sqrt{2}}{(1+2k^2)^2t_1}$	0	0

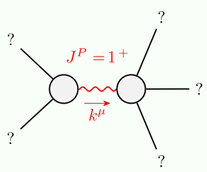
Source constraints

SO(3) irreps	Fundamental fields	Multiplicities
$\tau_{0^+}^{\#2}==0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta}==0$	1
$\tau_{0^+}^{\#1}-2ik\,\sigma_{0^+}^{\#1}==0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta}==\partial_\beta\partial^\beta\tau^\alpha{}_\alpha+2\,\partial_\chi\partial^\chi\partial_\beta\sigma^{\alpha\beta}{}_\alpha$	1
$\tau_{1^-}^{\#2\,\alpha}+2ik\,\sigma_{1^-}^{\#2\,\alpha}==0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi}==\partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta}+2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$\tau_{1^-}^{\#1\,\alpha}==0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi}==\partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$\tau_{1^+}^{\#1\,\alpha\beta}+ik\,\sigma_{1^+}^{\#2\,\alpha\beta}==0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi}+\partial_\chi\partial^\beta\tau^{\chi\alpha}+\partial_\chi\partial^\chi\tau^{\alpha\beta}+2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta}+2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi}==\partial_\chi\partial^\alpha\tau^{\chi\beta}+\partial_\chi\partial^\beta\tau^{\alpha\chi}+\partial_\chi\partial^\chi\tau^{\beta\alpha}+2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
$\tau_{2^+}^{\#1\,\alpha\beta}-2ik\,\sigma_{2^+}^{\#1\,\alpha\beta}==0$	$-i(4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\tau^{\chi\delta}+2\,\partial_\delta\partial^\delta\partial^\beta\partial^\alpha\tau^\chi{}_\chi-3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\chi\beta}-3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\chi\alpha}-3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\alpha\chi}-3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\alpha\beta}+3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\beta\alpha}+4ik^\chi\,\partial_\epsilon\partial_\chi\partial^\beta\partial^\alpha\sigma^{\delta\epsilon}{}_\delta-6ik^\chi\,\partial_\epsilon\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\delta\epsilon}-6ik^\chi\,\partial_\epsilon\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\delta\epsilon}+2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\tau^{\chi\delta}+6ik^\chi\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\alpha\delta\beta}+6ik^\chi\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\beta\delta\alpha}-2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\tau^\chi{}_\chi-4i\,\eta^{\alpha\beta}\,k^\chi\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\chi\sigma^{\delta\epsilon}{}_\delta)==0$	5
Total constraints/gauge generators:		16

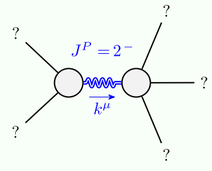
Quadratic (free) action

$$S==\iiiint(\tfrac{1}{6}(6t_1\,\omega^{\alpha\prime}{}_\alpha\,\omega_\prime{}^\theta{}_\theta+6\,f^{\alpha\beta}\,\tau_{\alpha\beta}+6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-12t_1\,\omega_\alpha{}^\theta{}_\theta\,\partial_\prime f^{\alpha\prime}+12t_1\,\omega_\prime{}^\theta{}_\theta\,\partial^\prime f^\alpha{}_\alpha-6t_1\,\partial_\prime f^\theta{}_\theta\partial^\prime f^\alpha{}_\alpha-6t_1\,\partial_\prime f^{\alpha\prime}\partial_\theta f_\alpha{}^\theta+12t_1\,\partial^\prime f^\alpha{}_\alpha\partial_\theta f_\prime{}^\theta+4t_1\,\omega_{\prime\theta\alpha}\,\partial^\theta f^{\alpha\prime}+4t_2\,\omega_{\prime\theta\alpha}\,\partial^\theta f^{\alpha\prime}-4t_1\,\partial_\alpha f_{\prime\theta}\partial^\theta f^{\alpha\prime}+2t_2\,\partial_\alpha f_{\prime\theta}\partial^\theta f^{\alpha\prime}-4t_1\,\partial_\alpha f_{\theta\prime}\partial^\theta f^{\alpha\prime}-t_2\,\partial_\alpha f_{\theta\prime}\partial^\theta f^{\alpha\prime}+2t_1\,\partial_\prime f_{\alpha\theta}\partial^\theta f^{\alpha\prime}-t_2\,\partial_\prime f_{\alpha\theta}\partial^\theta f^{\alpha\prime}+4t_1\,\partial_\theta f_{\alpha\prime}\partial^\theta f^{\alpha\prime}+t_2\,\partial_\theta f_{\alpha\prime}\partial^\theta f^{\alpha\prime}+2t_1\,\partial_\theta f_{\prime\alpha}\partial^\theta f^{\alpha\prime}-t_2\,\partial_\theta f_{\prime\alpha}\partial^\theta f^{\alpha\prime}+2(t_1+t_2)\,\omega_{\alpha\prime\theta}\,(\omega^{\alpha\prime\theta}+2\,\partial^\theta f^{\alpha\prime})+2\,\omega_{\alpha\theta\prime}\,((t_1-2t_2)\,\omega^{\alpha\prime\theta}+2(2t_1-t_2)\,\partial^\theta f^{\alpha\prime})-8r_1\,\partial_\beta\omega_{\alpha\prime\theta}\partial^\theta\omega^{\alpha\beta\prime}+4r_1\,\partial_\beta\omega_{\alpha\theta\prime}\partial^\theta\omega^{\alpha\beta\prime}-16r_1\,\partial_\beta\omega_{\prime\theta\alpha}\partial^\theta\omega^{\alpha\beta\prime}-4r_1\,\partial_\prime\omega_{\alpha\beta\theta}\partial^\theta\omega^{\alpha\beta\prime}+4r_1\,\partial_\theta\omega_{\alpha\beta\prime}\partial^\theta\omega^{\alpha\beta\prime}+4r_1\,\partial_\theta\omega_{\alpha\prime\beta}\partial^\theta\omega^{\alpha\beta\prime}+6r_5\,\partial_\prime\omega_\theta{}^\kappa{}_\kappa\partial^\theta\omega^{\alpha\prime}{}_\alpha-6r_5\,\partial_\theta\omega_\prime{}^\kappa{}_\kappa\partial^\theta\omega^{\alpha\prime}{}_\alpha-6r_5\,\partial_\alpha\omega^{\alpha\prime\theta}\,\partial_\kappa\omega_\prime{}^\kappa{}_\theta+12r_5\,\partial^\theta\omega^{\alpha\prime}{}_\alpha\partial_\kappa\omega_\prime{}^\kappa{}_\theta+6r_5\,\partial_\alpha\omega^{\alpha\prime\theta}\,\partial_\kappa\omega_\theta{}^\kappa{}_\prime-12r_5\,\partial^\theta\omega^{\alpha\prime}{}_\alpha\partial_\kappa\omega_\theta{}^\kappa{}_\prime))[t,x,y,z]\,dt\,dx\,dy\,dz$$

Massive and massless spectra



Massive particle	
Pole residue:	$\frac{-3t_1t_2(t_1+t_2)+6r_1(t_1{}^2+2t_2{}^2)+3r_5(t_1{}^2+2t_2{}^2)}{(2r_1+r_5)(t_1+t_2)(-3t_1t_2+4r_1(t_1+t_2)+2r_5(t_1+t_2))}>0$
Polarisations:	3
Square mass:	$-\frac{3t_1t_2}{2(2r_1+r_5)(t_1+t_2)}>0$
Spin:	1
Parity:	Even



Massive particle	
Pole residue:	$-\frac{1}{r_1}>0$
Polarisations:	5
Square mass:	$-\frac{t_1}{2r_1}>0$
Spin:	2
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_1<0\;\&\&\;r_5>-2r_1\;\&\&\;t_1>0\;\&\&\;-t_1<t_2<0$