Particle spectrograph

Wave operator and propagator

$\frac{t_1}{2}$	$-\frac{i k t_1}{\sqrt{2}}$	0
$\frac{i k t_1}{\sqrt{2}}$	$k^2 t_1$	0
0	0	$\frac{t_1}{2}$

Source constraints		
SO(3) irreps	Fundamental fields	Multiplicities
$\tau_{0^+}^{\#2} == 0$	$\partial_\beta \sigma_\alpha{}^{\alpha\beta} == 0$	1
$\tau_{0^+}^{\#1} == 0$	$\partial_\beta \tau_\alpha{}^{\alpha\beta} == \partial_\beta \tau^\alpha{}_\alpha$	1
$\sigma_{0^+}^{\#1} == 0$	$\partial_\beta \sigma^{\alpha\beta}{}_\alpha == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2\,i\,k\,\sigma_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\chi}{}_\gamma == \partial_\chi \partial^\chi \partial_\beta \tau^{\alpha\beta} + 2\,\partial_\delta \partial^\delta \partial_\chi \partial_\beta \sigma^{\alpha\beta\chi}$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\chi}{}_\gamma == \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	$\partial_\chi \partial^\alpha \tau^{\beta\chi} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + \partial_\chi \partial^\chi \tau^{\alpha\beta} + 2\,\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + 2\,\partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\beta\chi} == \partial_\chi \partial^\alpha \tau^{\chi\beta} + \partial_\chi \partial^\beta \tau^{\alpha\chi} + \partial_\chi \partial^\chi \tau^{\beta\alpha} + 2\,\partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta}$	3
$\tau_{2^+}^{\#1\,\alpha\beta} - 2\,i\,k\,\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	$-i\,(4\,\partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + 2\,\partial_\delta \partial^\delta \partial^\beta \sigma^{\alpha\chi}{}_\chi - 3\,\partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\chi\beta} - 3\,\partial_\delta \partial^\delta \partial_\chi \partial^\beta \tau^{\alpha\chi} - 3\,\partial_\delta \partial^\delta \partial_\chi \partial^\chi \tau^{\alpha\beta} + 3\,\partial_\delta \partial^\delta \partial_\chi \partial^\chi \tau^{\beta\alpha} + 4\,i\,k^\chi\,\partial_\varepsilon \partial_\chi \partial^\beta \sigma^{\alpha\varepsilon}{}_\delta - 6\,i\,k^\chi\,\partial_\varepsilon \partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\delta\varepsilon} - 6\,i\,k^\chi\,\partial_\varepsilon \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\delta\varepsilon} + 2\,\eta^{\alpha\beta}\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial_\chi \tau^{\chi\delta} + 6\,i\,k^\chi\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial_\chi \sigma^{\alpha\beta\delta} + 6\,i\,k^\chi\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial_\chi \sigma^{\beta\delta\alpha} - 2\,\eta^{\alpha\beta}\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\delta \tau^\chi{}_\chi - 4\,i\,\eta^{\alpha\beta}\,k^\chi\,\partial_\phi \partial^\phi \partial_\varepsilon \partial_\chi \sigma^{\delta\varepsilon}{}_\delta) == 0$	5
Total constraints/gauge generators:		17

Quadratic (free) action

$$S == \int\int\int (\tfrac{1}{6}(2\,t_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} - 4\,t_1\,\omega_\alpha{}^\theta{}_\theta\,\partial_\prime f^{\alpha\prime} + 4\,t_1\,\omega_\prime{}^\theta{}_\theta\,\partial^\prime f^\alpha{}_\alpha - 2\,t_1\,\partial_\prime f^{\alpha\prime}\,\partial_\theta f^\theta{}_\alpha - 2\,t_1\,\partial^\prime f^\alpha{}_\alpha\,\partial_\theta f_\prime{}^\theta{}_\theta - 6\,t_1\,\partial_\alpha f_{\prime\theta}\,\partial^\theta f^{\alpha\prime} - 3\,t_1\,\partial_\alpha f_\theta{}^\theta\,\partial^\theta f^{\alpha\prime} + 3\,t_1\,\partial_\prime f_{\alpha\theta}\,\partial^\theta f^{\alpha\prime} + 3\,t_1\,\partial_\theta f_{\alpha\prime}\,\partial^\theta f^{\alpha\prime} + 3\,t_1\,\partial_\theta f_{\prime\alpha}\,\partial^\theta f^{\alpha\prime} + 6\,t_1\,\omega_{\alpha\theta\prime}\,(\omega^{\alpha\prime\theta} + 2\,\partial^\theta f^{\alpha\prime}) + 8\,r_2\,\partial_\beta \omega_{\alpha\prime\theta}\,\partial^\theta \omega^{\alpha\beta\prime} - 4\,r_2\,\partial_\beta \omega_{\alpha\theta\prime}\,\partial^\theta \omega^{\alpha\beta\prime} + 4\,r_2\,\partial_\beta \omega_{\prime\theta\alpha}\,\partial^\theta \omega^{\alpha\beta\prime} - 2\,r_2\,\partial_\prime \omega_{\alpha\beta\theta}\,\partial^\theta \omega^{\alpha\beta\prime} + 2\,r_2\,\partial_\theta \omega_{\alpha\beta\prime}\,\partial^\theta \omega^{\alpha\beta\prime} - 4\,r_2\,\partial_\theta \omega_{\alpha\prime\beta}\,\partial^\theta \omega^{\alpha\beta\prime} + 6\,r_5\,\partial_\prime \omega_\theta{}^\kappa\,\partial^\theta \omega^{\alpha\prime}{}_\alpha - 6\,r_5\,\partial_\theta \omega^{\alpha\prime}{}_\prime{}^\theta\,\partial_\kappa \omega^\kappa{}_\alpha + 6\,r_5\,\partial_\alpha \omega^{\alpha\prime\theta}\,\partial_\kappa \omega_\prime{}^\kappa{}_\theta + 12\,r_5\,\partial^\theta \omega^{\alpha\prime}{}_\alpha\,\partial_\kappa \omega_\prime{}^\kappa{}_\theta + 6\,r_5\,\partial_\alpha \omega^{\alpha\prime\theta}\,\partial_\kappa \omega_\theta{}^\kappa{}_\prime - 12\,r_5\,\partial^\theta \omega^{\alpha\prime}{}_\alpha\,\partial_\kappa \omega_\theta{}^\kappa{}_\prime)) [t,\, x,\, y,\, z]\, dt\, dz\, dy\, dx\, dt$$

	$\sigma_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^+}^{\#2\,\alpha\beta}$	$\tau_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^-}^{\#1\,\alpha}$	$\sigma_{1^-}^{\#2\,\alpha}$	$\tau_{1^-}^{\#1\,\alpha}$	$\tau_{1^-}^{\#2\,\alpha}$
$\sigma_{1^+}^{\#1\,\alpha\beta}\,\dagger$	0	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	0	0	0	0
$\sigma_{1^+}^{\#2\,\alpha\beta}\,\dagger$	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$-\frac{2 k^2 r_5+t_1}{(1+k^2)^2 t_1^2}$	$-\frac{i(2 k^3 r_5+k t_1)}{(1+k^2)^2 t_1^2}$	0	0	0	0
$\tau_{1^+}^{\#1\,\alpha\beta}\,\dagger$	$\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	$\frac{i(2 k^3 r_5+k t_1)}{(1+k^2)^2 t_1^2}$	$\frac{-2 k^4 r_5+k^2 t_1}{(1+k^2)^2 t_1^2}$	0	0	0	0
$\sigma_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	0	$\frac{1}{k^2 r_5}$	$-\frac{1}{\sqrt{2}\,(k^2 r_5+2 k^4 r_5)}$	0	$-\frac{i}{k r_5+2 k^3 r_5}$
$\sigma_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	$-\frac{1}{\sqrt{2}\,(k^2 r_5+2 k^4 r_5)}$	$\frac{6 k^2 r_5+t_1}{2\,(k+2 k^3)^2 r_5 t_1}$	0	$\frac{i(6 k^2 r_5+t_1)}{\sqrt{2}\,k\,(1+2 k^2)^2 r_5 t_1}$
$\tau_{1^-}^{\#1\,\alpha}\,\dagger$	0	0	0	$\frac{i}{k r_5+2 k^3 r_5}$	0	0	0
$\tau_{1^-}^{\#2\,\alpha}\,\dagger$	0	0	0	$\frac{i}{k r_5+2 k^3 r_5}$	$-\frac{i(6 k^2 r_5+t_1)}{\sqrt{2}\,k\,(1+2 k^2)^2 r_5 t_1}$	0	$\frac{6 k^2 r_5+t_1}{(1+2 k^2)^2 r_5 t_1}$

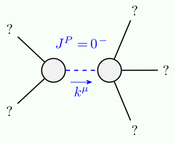
	$\sigma_{2^+}^{\#1\,\alpha\beta}$	$\tau_{2^+}^{\#1\,\alpha\beta}$	$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$
$\sigma_{2^+}^{\#1\,\alpha\beta}\,\dagger$	$\frac{2}{(1+2 k^2)^2 t_1}$	$\frac{2 i\sqrt{2}\,k}{(1+2 k^2)^2 t_1}$	0
$\tau_{2^+}^{\#1\,\alpha\beta}\,\dagger$	$\frac{2 i\sqrt{2}\,k}{(1+2 k^2)^2 t_1}$	$\frac{4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

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\,\dagger$	0	0	0	0
$f_{0^+}^{\#1}\,\dagger$	0	0	0	0
$f_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\,\dagger$	0	0	0	$k^2 r_2 - t_1$

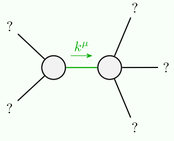
	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\,\dagger$	0	0	0	0
$\tau_{0^+}^{\#1}\,\dagger$	0	0	0	0
$\tau_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{1}{k^2 r_2 t_1}$

	$\omega_{1^+\alpha\beta}^{\#1}$	$\omega_{1^+\alpha\beta}^{\#2}$	$f_{1^+\alpha\beta}^{\#1}$	$\omega_{1^-\alpha}^{\#1}$	$\omega_{1^-\alpha}^{\#2}$	$f_{1^-\alpha}^{\#1}$	$f_{1^-\alpha}^{\#2}$
$\omega_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$k^2 r_5 - \frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{i k t_1}{\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}\,\dagger^{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$f_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{i k t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\omega_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	$k^2 r_5 + \frac{t_1}{6}$	$\frac{t_1}{3\sqrt{2}}$	0	$\frac{i k t_1}{3}$
$\omega_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	0	$\frac{1}{3} i \sqrt{2}\, k t_1$
$f_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$-\frac{1}{3} i k t_1$	$-\frac{1}{3} i \sqrt{2}\, k t_1$	0	$\frac{2 k^2 t_1}{3}$

Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$\frac{t_1}{r_2} > 0$
Spin:	0
Parity:	Odd



Quadratic pole	
Pole residue:	$-\frac{1}{r_5 t_1^2} > 0$
Polarisations:	2

Unitarity conditions

$r_2 < 0$ && $r_5 < 0$ && $t_1 < 0$