Particle spectrograph

Wave operator and propagator

Source constraints		
SO(3) irreps	Fundamental fields	Multiplicities
$\tau_0^{\#2}$ == 0	$\partial_\beta \partial_\alpha \tau^{\alpha\beta}$ == 0	1
$\tau_0^{\#1}$ == 0	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} = = \partial_\beta \partial^\beta \tau^\alpha{}_\alpha$	1
$\tau_1^{\#2\,\alpha} + 2\,i\,k\,\sigma_1^{\#1\,\alpha}$ == 0	$\partial_\chi \partial_\beta \partial_\alpha \tau^{\alpha\beta} + 2\,(\partial_\alpha \partial^\sigma \partial_\chi \partial_\sigma \sigma^{\alpha\beta}{}_\beta - \partial_\alpha \partial^\sigma \partial_\chi \partial_\beta \sigma^{\alpha\beta}{}_\sigma + \partial_\delta \partial^\sigma \partial_\chi \partial^\chi \sigma^{\alpha\beta}{}_\beta) = = \partial_\chi \partial^\chi \partial_\beta \tau^{\alpha\beta}$	3
$\sigma_1^{\#1\,\alpha}$ == 0	$\partial_\chi \partial_\beta \sigma^{\alpha\beta}{}_\beta = = \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$\sigma_1^{\#1\,\alpha}$ == $\sigma_1^{\#2\,\alpha}$	$\partial_\chi \partial^\sigma \sigma^{\alpha\beta}{}_\beta + \partial_\chi \partial^\chi \sigma^{\alpha\beta}{}_\beta$ == 0	3
$\tau_1^{\#1\,\alpha\beta} + i\,k\,\sigma_1^{\#2\,\alpha\beta}$ == 0	$\partial_\chi \partial^\alpha \tau^{\beta\chi} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + \partial_\chi \partial^\chi \tau^{\alpha\beta} + 2\,\partial_\chi \partial^\alpha \sigma^{\beta\chi}{}_\delta + 2\,\partial_\chi \partial^\sigma \partial_\chi \sigma^{\alpha\beta\chi} == \partial_\chi \partial^\alpha \tau^{\chi\beta} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + \partial_\chi \partial^\chi \tau^{\beta\alpha} + 2\,\partial_\chi \partial_\delta \partial^\sigma \sigma^{\alpha\chi\delta}$	3
$\tau_2^{\#1\,\alpha\beta} - 2\,i\,k\,\sigma_2^{\#1\,\alpha\beta}$ == 0	$-i\,(4\,\partial_\chi \partial_\sigma \partial^\sigma \tau^{\chi\delta} + 2\,\partial_\sigma \partial^\sigma \partial^\chi \tau^{\delta\chi} - 3\,\partial_\sigma \partial^\delta \partial_\chi \partial^\sigma \tau^{\chi\beta} - 3\,\partial_\sigma \partial^\sigma \partial_\chi \partial^\beta \tau^{\chi\alpha} + 3\,\partial_\sigma \partial^\beta \partial_\chi \partial^\chi \tau^{\alpha\beta} + 3\,\partial_\sigma \partial^\alpha \partial_\chi \partial^\chi \tau^{\beta\alpha} + 4\,i\,k^\chi\,\partial_\sigma \partial_\chi \partial^\beta \partial^\alpha \sigma^{\sigma\delta}{}_\delta - 6\,i\,k^\chi\,\partial_\sigma \partial_\chi \partial^\sigma \sigma^{\alpha\beta\delta}{}_\delta + 6\,i\,k^\chi\,\partial_\sigma \partial_\chi \partial^\alpha \sigma^{\sigma\beta\delta}{}_\delta + 2\,\eta^{\alpha\beta}\,\partial_\sigma \partial^\sigma \partial_\chi \partial^\chi \sigma^{\delta\delta}{}_\delta + 6\,i\,k^\chi\,\partial_\sigma \partial^\sigma \partial_\chi \partial_\delta \sigma^{\alpha\beta\delta}{}_\delta - 2\,\eta^{\alpha\beta}\,\partial_\sigma \partial^\sigma \partial_\chi \partial^\delta \sigma^{\chi}{}_\chi{}^\delta + 4\,i\,\eta^{\alpha\beta}\,k^\chi\,\partial_\sigma \partial^\sigma \partial_\chi \partial_\delta \sigma^{\delta\chi}{}_\delta)$ == 0	5
Total constraints/gauge generators:		19

Quadratic (free) action

$$S = = \int\int\int (\tau^{\alpha\beta}\ \tau_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + \frac{1}{6}\,t_1\,(2\,\mathcal{A}^{\alpha\prime}{}_\alpha{}^\theta{}_\theta\,\mathcal{A}^{\prime}{}_\theta{}^\alpha{}_\theta - 4\,\mathcal{A}^{\alpha}{}_\theta{}^\theta{}_\theta\,\partial_\prime f^{\prime\alpha} + 4\,\mathcal{A}^{\prime}{}_\theta{}^\theta{}_\theta\,\partial^\prime f^\alpha{}_\alpha - 2\,\partial_\prime f^\theta{}_\theta - \partial^\prime f^\alpha{}_\alpha - 2\,\partial_\prime f^{\alpha\prime}\,\partial_\theta f^\theta{}_\alpha + 4\,\partial^\prime f^\alpha{}_\alpha\,\partial_\theta f^\theta{}_\prime - 6\,\partial_\alpha f_{\prime\theta}\,\partial^\theta f^{\alpha\prime} - 3\,\partial_\alpha f_{\theta\prime}\,\partial^\theta f^{\alpha\prime} + 3\,\partial_\theta f_{\alpha\theta}\,\partial^\theta f^{\alpha\prime} + 3\,\partial_\theta f_{\alpha\prime}\,\partial^\theta f^{\alpha\prime} + 6\,\mathcal{A}^{\alpha\prime\theta}\,\partial_\theta f_{\alpha\prime} - 3\,\partial_\theta f_{\prime\alpha}\,\partial^\theta f^{\alpha\prime} + 2\,\partial^\theta f^{\alpha\prime}) - 4\,r_3\,(\partial_\beta \mathcal{A}^\prime{}_\theta{}^\theta{}_\alpha\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha + \partial_\alpha \mathcal{A}^{\alpha\beta\prime}\,\partial_\theta \mathcal{A}^\prime{}_\beta{}^\theta{}_\alpha - 2\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\theta \mathcal{A}^\prime{}_\beta{}^\theta{}_\alpha + \partial_\theta \mathcal{A}^{\prime}{}_\beta{}^\theta{}_\alpha\,\partial^\theta \mathcal{A}^{\alpha\beta}{}_\alpha) + \frac{1}{3}\,r_1\,(9\,\partial_\beta \mathcal{A}^\prime{}_\theta{}^\theta{}_\alpha\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha + 3\,\partial^\prime \mathcal{A}_\beta{}^\theta{}_\theta\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha + 3\,\partial_\alpha \mathcal{A}^{\alpha\beta\prime}\,\partial_\theta \mathcal{A}^\theta{}_{\beta\prime} - 6\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\theta \mathcal{A}^\theta{}_{\beta\prime} + 9\,\partial_\alpha \mathcal{A}^{\alpha\beta\prime}\,\partial_\theta \mathcal{A}^\theta{}_\beta - 18\,\partial^\prime \mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\alpha \mathcal{A}^\prime{}_\beta{}^\theta{}_\theta - 4\,\partial_\beta \mathcal{A}_{\alpha\prime\theta}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime} + 2\,\partial_\beta \mathcal{A}_{\alpha\theta\prime}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime} + 4\,\partial_\beta \mathcal{A}_{\prime\theta\alpha}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime} - 2\,\partial_\alpha \mathcal{A}_{\alpha\beta\theta}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime} + 2\,\partial_\alpha \mathcal{A}_{\alpha\beta\prime}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime} + 2\,\partial_\alpha \mathcal{A}_{\alpha\prime\beta}\,\partial^\theta \mathcal{A}^{\alpha\beta\prime}))[t,\ x,\ y,\ z]\,dz\,dy\,dx\,dt$$

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	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
$\sigma_{1^+}^{\#2}{}^\dagger{}^{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2\,t_1}$	$-\frac{2\,k^2\,\gamma_1+t_1}{(1+k^2)^2\,t_1^2}$	$-\frac{i\,(2\,k^3\,\gamma_1+k\,t_1)}{(1+k^2)^2\,t_1^2}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	$\frac{i\,\sqrt{2}\,k}{t_1+k^2\,t_1}$	$\frac{i\,(2\,k^3\,\gamma_1+k\,t_1)}{(1+k^2)^2\,t_1^2}$	$\frac{2\,k^4\,\gamma_1+k^2\,t_1}{(1+k^2)^2\,t_1^2}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^\dagger{}^{\alpha}$	0	0	0	$\frac{6}{(3+4\,k^2)^2\,t_1}$	$\frac{6\,\sqrt{2}}{(3+4\,k^2)^2\,t_1}$	0	$\frac{12\,i\,k}{(3+4\,k^2)^2\,t_1}$
$\sigma_{1^-}^{\#2}{}^\dagger{}^{\alpha}$	0	0	0	$\frac{6\,\sqrt{2}}{(3+4\,k^2)^2\,t_1}$	$\frac{12}{(3+4\,k^2)^2\,t_1}$	0	$\frac{12\,i\,\sqrt{2}\,k}{(3+4\,k^2)^2\,t_1}$
$\tau_{1^-}^{\#1}{}^\dagger{}^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^\dagger{}^{\alpha}$	0	0	0	$-\frac{12\,i\,k}{(3+4\,k^2)^2\,t_1}$	$-\frac{12\,i\,\sqrt{2}\,k}{(3+4\,k^2)^2\,t_1}$	0	$\frac{24\,k^2}{(3+4\,k^2)^2\,t_1}$

	$\mathcal{A}_{1^+}^{\#1}{}_{\alpha\beta}$	$\mathcal{A}_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\mathcal{A}_{1^-}^{\#1}{}_{\alpha}$	$\mathcal{A}_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\mathcal{A}_{1^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	$k^2\,r_1 - \frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{i\,k\,t_1}{\sqrt{2}}$	0	0	0	0
$\mathcal{A}_{1^+}^{\#2}{}^\dagger{}^{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$f_{1^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	$\frac{i\,k\,t_1}{\sqrt{2}}$	0	0	0	0	$\frac{i\,k\,t_1}{3}$	0
$\mathcal{A}_{1^-}^{\#1}{}^\dagger{}^{\alpha}$	0	0	0	$\frac{t_1}{6}$	$\frac{t_1}{3\,\sqrt{2}}$	0	$\frac{1}{3}\,i\,\sqrt{2}\,k\,t_1$
$\mathcal{A}_{1^-}^{\#2}{}^\dagger{}^{\alpha}$	0	0	0	$\frac{t_1}{3\,\sqrt{2}}$	$\frac{t_1}{3}$	0	0
$f_{1^-}^{\#1}{}^\dagger{}^{\alpha}$	0	0	0	0	0	0	$\frac{2\,k^2\,t_1}{3}$
$f_{1^-}^{\#2}{}^\dagger{}^{\alpha}$	0	0	0	$-\frac{1}{3}\,i\,k\,t_1$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_1$	0	$\frac{2\,k^2\,t_1}{3}$

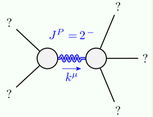
	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^\dagger$	$\frac{1}{6\,k^2\,(-r_1+r_3)}$	0	0	0
$\tau_{0^+}^{\#1}{}^\dagger$	0	0	0	0
$\tau_{0^+}^{\#2}{}^\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}{}^\dagger$	0	0	0	$-\frac{1}{t_1}$

	$\mathcal{A}_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\mathcal{A}_{0^-}^{\#1}$
$\mathcal{A}_{0^+}^{\#1}{}^\dagger$	$6\,k^2\,(-r_1+r_3)$	0	0	0
$f_{0^+}^{\#1}{}^\dagger$	0	0	0	0
$f_{0^+}^{\#2}{}^\dagger$	0	0	0	0
$\mathcal{A}_{0^-}^{\#1}{}^\dagger$	0	0	0	$-t_1$

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

	$\sigma_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\mathcal{A}_{2^+}^{\#1}{}_{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{i\,k\,t_1}{\sqrt{2}}$	0
$f_{2^+}^{\#1}{}^\dagger{}^{\alpha\beta}$	$\frac{i\,k\,t_1}{\sqrt{2}}$	$k^2\,t_1$	0
$\mathcal{A}_{2^+}^{\#1}{}^\dagger{}^{\alpha\beta\chi}$	0	0	$k^2\,r_1+\frac{t_1}{2}$

Massive and massless spectra



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

(No massless particles)

Unitarity conditions

$r_1 < 0$ && $t_1 > 0$