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
$\sigma_{0^+}^{\#1} == 0$	xAct`xTensor`Private`Reconstruct[Symmetry[4, $\partial^{\bullet 4}\sigma^{\bullet 1\bullet 2\bullet 3}$, {$\bullet 1 \to$ a, $\bullet 2 \to$ b, $\bullet 3 \to$ -a, $\bullet 4 \to$ -b}, StrongGenSet[{1, 2, 4}, GenSet[-(1,2)]]], {-1, {a , -a , b , -b}][[{1, 3, 5, 2}]]}] == 0	1
$\tau_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta}$	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
$\sigma_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\,\sigma_{1^+}^{\#1\,\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} + \partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\chi\alpha} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha} + \partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta}$	3
$\sigma_{1^+}^{\#1\,\alpha\beta} == \sigma_{1^+}^{\#2\,\alpha\beta}$	$3\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta} == 3\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\chi\alpha}$	3
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	$4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\tau^{\chi\delta} + 2\,\partial_\delta\partial^\delta\partial^\beta\partial^\alpha\tau^\chi{}_\chi + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\alpha\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\beta\alpha} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\tau^{\chi\delta} == 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\beta\chi} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\chi\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\alpha\chi} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\chi\alpha} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\tau^\chi{}_\chi$	5
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	$3\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 3\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\sigma^{\chi\delta}{}_\chi == 2\,\partial_\delta\partial^\beta\partial^\alpha\sigma^{\chi\delta}{}_\chi + 3\,(\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\chi\beta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\chi\alpha})$	5
Total constraints/gauge generators:		28

Quadratic (free) action
$S == \int\int\int\int(\frac{1}{6}(6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 12\,r_1\,\partial_\beta\omega_\iota{}^\theta{}_\theta\partial^\prime\omega^{\alpha\beta}{}_\alpha + 12\,r_1\,\partial_\iota\omega_\beta{}^\theta{}_\theta\partial^\prime\omega^{\alpha\beta}{}_\alpha + 12\,r_1\,\partial_\alpha\omega^{\alpha\beta\prime}\,\partial_\theta\omega_\beta{}^\theta{}_\iota - 24\,r_1\,\partial^\prime\omega^{\alpha\beta}{}_\alpha\,\partial_\theta\omega_\beta{}^\theta{}_\iota - 12\,r_1\,\partial_\alpha\omega^{\alpha\beta\prime}\,\partial_\theta\omega_\iota{}^\theta{}_\beta + 24\,r_1\,\partial^\prime\omega^{\alpha\beta}{}_\alpha\,\partial_\theta\omega_\iota{}^\theta{}_\beta + 4\,t_2\,\omega_{\iota\theta\alpha}\,\partial^\theta f^{\alpha\prime} + 2\,t_2\,\partial_\alpha f_{\iota\theta}\,\partial^\theta f^{\alpha\prime} - t_2\,\partial_\alpha f_{\theta\iota}\,\partial^\theta f^{\alpha\prime} - t_2\,\partial_\iota f_{\alpha\theta}\,\partial^\theta f^{\alpha\prime} + t_2\,\partial_\theta f_{\alpha\iota}\,\partial^\theta f^{\alpha\prime} - t_2\,\partial_\theta f_{\iota\alpha}\,\partial^\theta f^{\alpha\prime} - 4\,t_2\,\omega_{\alpha\theta\iota}\,(\omega^{\alpha\iota\theta} + \partial^\theta f^{\alpha\prime}) + 2\,t_2\,\omega_{\alpha\iota\theta}\,(\omega^{\alpha\iota\theta} + 2\,\partial^\theta f^{\alpha\prime}) - 8\,r_1\,\partial_\beta\omega_{\alpha\iota\theta}\,\partial^\theta\omega^{\alpha\beta\prime} + 8\,r_2\,\partial_\beta\omega_{\alpha\iota\theta}\,\partial^\theta\omega^{\alpha\beta\prime} + 4\,r_1\,\partial_\beta\omega_{\alpha\theta\iota}\,\partial^\theta\omega^{\alpha\beta\prime} - 4\,r_2\,\partial_\beta\omega_{\alpha\theta\iota}\,\partial^\theta\omega^{\alpha\beta\prime} - 16\,r_1\,\partial_\beta\omega_{\iota\theta\alpha}\,\partial^\theta\omega^{\alpha\beta\prime} + 4\,r_2\,\partial_\beta\omega_{\iota\theta\alpha}\,\partial^\theta\omega^{\alpha\beta\prime} - 4\,r_1\,\partial_\iota\omega_{\alpha\beta\theta}\,\partial^\theta\omega^{\alpha\beta\prime} - 2\,r_2\,\partial_\iota\omega_{\alpha\beta\theta}\,\partial^\theta\omega^{\alpha\beta\prime} + 4\,r_1\,\partial_\theta\omega_{\alpha\beta\iota}\,\partial^\theta\omega^{\alpha\beta\prime} + 2\,r_2\,\partial_\theta\omega_{\alpha\beta\iota}\,\partial^\theta\omega^{\alpha\beta\prime} - 4\,r_2\,\partial_\theta\omega_{\alpha\iota\beta}\,\partial^\theta\omega^{\alpha\beta\prime}))[t, x, y, z]\,dt\,dx\,dy\,dz$

	$\omega_{1^+}^{\#1\,\alpha\beta}$	$\omega_{1^+}^{\#2\,\alpha\beta}$	$f_{1^+}^{\#1\,\alpha\beta}$	$\omega_{1^-}^{\#1\,\alpha}$	$\omega_{1^-}^{\#2\,\alpha}$	$f_{1^-}^{\#1\,\alpha}$	$f_{1^-}^{\#2\,\alpha}$
$\omega_{1^+}^{\#1\,\dagger\,\alpha\beta}$	$\frac{2t_2}{3}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{1}{3}i\sqrt{2}\,k\,t_2$	0	0	0	0
$\omega_{1^+}^{\#2\,\dagger\,\alpha\beta}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{t_2}{3}$	$\frac{ikt_2}{3}$	0	0	0	0
$f_{1^+}^{\#1\,\dagger\,\alpha\beta}$	$-\frac{1}{3}i\sqrt{2}\,k\,t_2$	$-\frac{1}{3}ikt_2$	$\frac{k^2t_2}{3}$	0	0	0	0
$\omega_{1^-}^{\#1\,\dagger\,\alpha}$	0	0	0	$-k^2r_1$	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

	$\sigma_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^+}^{\#2\,\alpha\beta}$	$\tau_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^-}^{\#1\,\alpha}$	$\sigma_{1^-}^{\#2\,\alpha}$	$\tau_{1^-}^{\#1\,\alpha}$	$\tau_{1^-}^{\#2\,\alpha}$
$\sigma_{1^+}^{\#1\,\dagger\,\alpha\beta}$	$\frac{6}{(3+k^2)^2t_2}$	$\frac{3\sqrt{2}}{(3+k^2)^2t_2}$	$\frac{3i\sqrt{2}\,k}{(3+k^2)^2t_2}$	0	0	0	0
$\sigma_{1^+}^{\#2\,\dagger\,\alpha\beta}$	$\frac{3\sqrt{2}}{(3+k^2)^2t_2}$	$\frac{3}{(3+k^2)^2t_2}$	$\frac{3ik}{(3+k^2)^2t_2}$	0	0	0	0
$\tau_{1^+}^{\#1\,\dagger\,\alpha\beta}$	$-\frac{3i\sqrt{2}\,k}{(3+k^2)^2t_2}$	$-\frac{3ik}{(3+k^2)^2t_2}$	$\frac{3k^2}{(3+k^2)^2t_2}$	0	0	0	0
$\sigma_{1^-}^{\#1\,\dagger\,\alpha}$	0	0	0	$-\frac{1}{k^2r_1}$	0	0	0
$\sigma_{1^-}^{\#2\,\dagger\,\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#1\,\dagger\,\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2\,\dagger\,\alpha}$	0	0	0	0	0	0	0

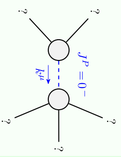
	$\omega_{0^+}^{\#1\,\dagger}$	$f_{0^+}^{\#2\,\dagger}$	$f_{0^+}^{\#1\,\dagger}$	$\omega_{0^+}^{\#1\,\dagger}$
$\omega_{0^+}^{\#1\,\dagger}$	0	0	0	0
$f_{0^+}^{\#2\,\dagger}$	0	0	0	0
$f_{0^+}^{\#1\,\dagger}$	0	0	0	0
$\omega_{0^+}^{\#1\,\dagger}$	0	0	0	$k^2r_2+t_2$

	$\omega_{2^+}^{\#1\,\dagger\,\alpha\beta}$	$f_{2^+}^{\#1\,\dagger\,\alpha\beta}$	$\omega_{2^+}^{\#1\,\dagger\,\alpha\beta}$
$\omega_{2^+}^{\#1\,\dagger\,\alpha\beta}$	0	0	0
$f_{2^+}^{\#1\,\dagger\,\alpha\beta}$	0	0	0
$\omega_{2^+}^{\#1\,\dagger\,\alpha\beta}$	0	0	k^2r_1

	$\sigma_{2^+}^{\#1\,\alpha\beta}$	$\tau_{2^+}^{\#1\,\alpha\beta}$	$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$
$\sigma_{2^+}^{\#1\,\dagger\,\alpha\beta}$	0	0	0
$\tau_{2^+}^{\#1\,\dagger\,\alpha\beta}$	0	0	0
$\sigma_{2^-}^{\#1\,\dagger\,\alpha\beta\chi}$	0	0	$\frac{1}{k^2r_1}$

	$\sigma_{0^-}^{\#1\,\dagger}$	$\tau_{0^+}^{\#2\,\dagger}$	$\tau_{0^+}^{\#1\,\dagger}$	$\sigma_{0^+}^{\#1\,\dagger}$
$\sigma_{0^+}^{\#1\,\dagger}$	0	0	0	0
$\tau_{0^+}^{\#1\,\dagger}$	0	0	0	0
$\tau_{0^+}^{\#2\,\dagger}$	0	0	0	0
$\sigma_{0^-}^{\#1\,\dagger}$	$\frac{1}{k^2r_2+t_2}$	0	0	0

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

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