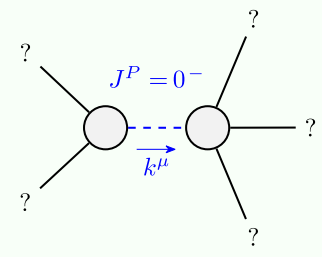


Particle spectrograph

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

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

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

Quadratic (free) action

S==

$$\int \int \int \int (\frac{1}{6} (6 t_1 \omega_{\alpha}^{\alpha i} \omega_{\theta}^{\theta} \omega_{\theta}^{\alpha\beta} \tau_{\alpha\beta} + 6 f^{\alpha\beta} \tau_{\alpha\beta} + 6 \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} - 12 t_1 \omega_{\alpha}^{\theta} \partial_i f^{\alpha i} + 12 t_1 \omega_{\theta}^{\alpha} \partial_i f^{\alpha i} - 6 t_1 \partial_i f_{\alpha}^{\theta} \partial^{\theta} f_{\theta}^{\alpha} - 6 t_1 \partial_i f_{\alpha}^{\alpha i} \partial_{\theta} f_{\theta}^{\theta} + 12 t_1 \partial_i f_{\alpha}^{\alpha} \partial_{\theta} f_{\theta}^{\theta} + 4 t_1 \omega_{\theta\alpha} \partial^{\theta} f^{\alpha i} + 4 t_2 \omega_{\theta\alpha} \partial^{\theta} f^{\alpha i} - 4 t_1 \partial_{\alpha} f_{\theta} \partial^{\theta} f^{\alpha i} + 2 t_2 \partial_{\alpha} f_{\theta} \partial^{\theta} f^{\alpha i} - 4 t_1 \partial_{\alpha} f_{\theta i} \partial^{\theta} f^{\alpha i} - t_2 \partial_{\alpha} f_{\theta i} \partial^{\theta} f^{\alpha i} + 2 t_1 \partial_i f_{\alpha\theta} \partial^{\theta} f^{\alpha i} - t_2 \partial_i f_{\alpha\theta} \partial^{\theta} f^{\alpha i} + 4 t_1 \partial_{\theta} f_{\alpha i} \partial^{\theta} f^{\alpha i} + t_2 \partial_{\theta} f_{\alpha i} \partial^{\theta} f^{\alpha i} + 2 t_1 \partial_{\theta} f_{\alpha} \partial^{\theta} f^{\alpha i} - t_2 \partial_{\theta} f_{\alpha} \partial^{\theta} f^{\alpha i} + 2 (t_1 + t_2) \omega_{\alpha i \theta} (\omega^{\alpha i \theta} + 2 \partial^{\theta} f^{\alpha i}) + 2 \omega_{\alpha \theta i} ((t_1 - 2 t_2) \omega^{\alpha i \theta} + 2 (2 t_1 - t_2) \partial^{\theta} f^{\alpha i}) + 8 r_2 \partial_{\beta} \omega_{\alpha i \theta} \partial^{\theta} \omega^{\alpha \beta i} - 4 r_2 \partial_{\beta} \omega_{\alpha \theta i} \partial^{\theta} \omega^{\alpha \beta i} + 4 r_2 \partial_{\beta} \omega_{\theta \alpha i} \partial^{\theta} \omega^{\alpha \beta i} - 2 r_2 \partial_i \omega_{\alpha \beta \theta} \partial^{\theta} \omega^{\alpha \beta i} + 2 r_2 \partial_{\theta} \omega_{\alpha \beta i} \partial^{\theta} \omega^{\alpha \beta i} - \partial^{\theta} \omega^{\alpha \beta i} - 2 r_2 \partial_i \omega_{\alpha \beta \theta} \partial^{\theta} \omega^{\alpha \beta i}))[t, x, y, z] d i z d y d x d t$$

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

$\omega_{1+}^{\#1} \uparrow^{\alpha\beta}$	$\omega_{1+}^{\#2} \uparrow^{\alpha\beta}$	$f_{1+}^{\#1} \uparrow^{\alpha\beta}$	$\omega_{1-}^{\#1} \uparrow^{\alpha}$	$\omega_{1-}^{\#2} \uparrow^{\alpha}$	$f_{1-}^{\#1} \uparrow^{\alpha}$	$f_{1-}^{\#2} \uparrow^{\alpha}$
$\frac{1}{6}(t_1+4t_2)$	$-\frac{t_1-2t_2}{3\sqrt{2}}$	$-\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	0	0	0	0
$-\frac{t_1-2t_2}{3\sqrt{2}}$	$\frac{t_1+t_2}{3}$	$\frac{1}{3}ik(t_1+t_2)$	0	0	0	0
$\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	$-\frac{1}{3}ik(t_1+t_2)$	$\frac{1}{3}k^2(t_1+t_2)$	0	0	0	0
0	0	0	$-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$ik t_1$
0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

$\sigma_{0+}^{\#1} \uparrow^{\alpha\beta}$	$\tau_{0+}^{\#1} \uparrow^{\alpha\beta}$	$\tau_{0+}^{\#2} \uparrow^{\alpha\beta}$	$\sigma_{0-}^{\#1} \uparrow^{\alpha\beta}$	$\sigma_{2+}^{\#1} \uparrow^{\alpha\beta}$	$\tau_{2+}^{\#1} \uparrow^{\alpha\beta}$	$\sigma_{2-}^{\#1} \uparrow^{\alpha\beta\chi}$
$-\frac{1}{(1+2k^2)^2t_1}$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	0	0	$\frac{2}{(1+2k^2)^2t_1}$	$-\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$	0
$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	$-\frac{2k^2}{(1+2k^2)^2t_1}$	0	0	$\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$	$\frac{4k^2}{(1+2k^2)^2t_1}$	0
0	0	0	0	$\sigma_{2-}^{\#1} \uparrow^{\alpha\beta\chi}$	0	$\frac{2}{t_1}$
0	0	0	$\frac{1}{k^2r_2+t_2}$	$\omega_{0+}^{\#1}$	$f_{0+}^{\#2}$	$\omega_{0-}^{\#1}$

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

$\omega_0^{\#1} \uparrow^{\alpha\beta}$	$f_0^{\#1} \uparrow^{\alpha\beta}$	$\omega_0^{\#2} \uparrow^{\alpha\beta}$
$-t_1$	$i\sqrt{2}kt_1$	0
$-i\sqrt{2}kt_1$	$-2k^2t_1$	0
0	0	0
0	0	$k^2r_2+t_2$