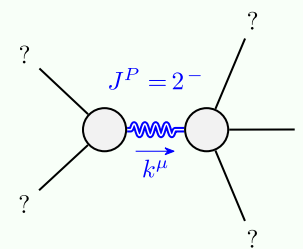


Particle spectrograph

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

Massive and massless spectra



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

(No massless particles)
(seipless particles)

Unitarity conditions

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

Quadratic (free) action

$$S = \iiint (\frac{1}{6} (2 \, \omega^{\alpha i}_\alpha (t_1 \, \omega^{\theta}_{\prime \, \theta} - 2 \, t_3 \, \omega^{\kappa}_{\prime \, \kappa}) + 6 \, f^{\alpha\beta} \, \tau_{\alpha\beta} + 6 \, \omega^{\alpha\beta\chi} \, \sigma_{\alpha\beta\chi} - 4 \, t_1 \, \omega^{\theta}_{\alpha \, \theta} \partial_\prime f^{\alpha i} + 8 \, t_3 \, \omega^{\kappa}_{\alpha \, \kappa} \partial_\prime f^{\alpha i} + 4 \, t_1 \, \omega^{\theta}_{\prime \, \theta} \partial^\prime f^{\alpha}_{\alpha} - 8 \, t_3 \, \omega^{\kappa}_{\prime \, \kappa} \partial^\prime f^{\alpha}_{\alpha} - 2 \, t_1 \, \partial_\prime f^{\theta}_{\theta} \partial^\prime f^{\alpha}_{\alpha} + 4 \, t_3 \, \partial_\prime f^{\kappa}_{\kappa} \partial^\prime f^{\alpha}_{\alpha} - 6 \, r_1 \partial_\beta \omega^{\theta}_{\prime \, \theta} \partial^\prime \omega^{\alpha\beta}_{\alpha} + 6 \, r_1 \partial_\prime \omega^{\theta}_{\beta \, \theta} \omega^{\alpha\beta}_{\alpha} - 2 \, t_1 \partial_\prime f^{\alpha i} \partial_\theta f^{\theta}_{\alpha} + 4 \, t_1 \partial^\prime f^{\alpha}_{\alpha} \partial_\theta f^{\theta}_{\prime} + 6 \, r_1 \partial_\alpha \omega^{\alpha\beta i} \partial_\theta \omega^{\theta}_{\beta \, \prime} - 12 \, r_1 \partial^\prime \omega^{\alpha\beta}_{\alpha} \partial_\theta \omega_{\beta \, \prime} - 6 \, r_1 \partial_\alpha \omega^{\alpha\beta i} \partial_\theta \omega_{\prime \, \beta} + 12 \, r_1 \partial^\prime \omega^{\alpha\beta}_{\alpha} \partial_\theta \omega_{\prime \, \beta} - 6 \, t_1 \partial_\alpha f_{\prime \, \theta} \partial^\theta f^{\alpha i} - 3 \, t_1 \partial_\alpha f_{\theta \prime} \partial^\theta f^{\alpha i} + 3 \, t_1 \partial_\prime f_{\alpha\theta} \partial^\theta f^{\alpha i} + 3 \, t_1 \partial_\theta f_{\alpha i} \partial^\theta f^{\alpha i} + 3 \, t_1 \partial_\theta f_{\prime \alpha} \partial^\theta f^{\alpha i} + 6 \, t_1 \, \omega_{\alpha\theta i} (\, \omega^{\alpha i\theta} + 2 \, \partial^\theta f^{\alpha i}) - 8 \, r_1 \partial_\beta \omega_{\alpha i \theta} \partial^\theta \omega^{\alpha\beta i} + 4 \, r_1 \partial_\beta \omega_{\alpha\theta i} \partial^\theta \omega^{\alpha\beta i} - 16 \, r_1 \partial_\beta \omega_{\prime \theta \alpha} \partial^\theta \omega^{\alpha\beta i} - 4 \, r_1 \partial_\prime \omega_{\alpha\beta\theta} \partial^\theta \omega^{\alpha\beta i} + 4 \, r_1 \partial_\theta \omega_{\alpha\beta i} \partial^\theta \omega^{\alpha\beta i} + 4 \, r_1 \partial_\theta \omega_{\alpha\beta i} \partial^\theta \omega^{\alpha\beta i} + 4 \, t_3 \partial_\prime f^{\alpha i} \partial_\kappa f^{\kappa}_{\alpha} - 8 \, t_3 \partial_\prime f^{\alpha}_{\alpha} \partial_\kappa f^{\kappa}_{\prime}) [t, \, x, \, y, \, z] dz \, dy \, dx \, dt$$

$\sigma_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1+}^{\#2}$	$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1-}^{\#1}$	$\sigma_{1-}^{\#2}$	$\tau_{1-}^{\#1}$	$\tau_{1-}^{\#2}$
0	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$-\frac{i\sqrt{2}k}{t_1+k^2t_1}$	0	0	0	0
$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$\frac{-2k^2r_1+t_1}{(1+k^2)^2t_1^2}$	$-\frac{i(2k^3r_1-kt_1)}{(1+k^2)^2t_1^2}$	0	0	0	0
$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{i\sqrt{2}k}{t_1+k^2t_1}$	$\frac{-2k^4r_1+k^2t_1}{(1+k^2)^2t_1^2}$	0	0	0	0
$\sigma_{1-}^{\#1} \dagger^\alpha$	0	0	$\frac{2(t_1+t_3)}{3t_1t_3}$	$-\frac{\sqrt{2}(t_1-2t_3)}{3(1+2k^2)t_1t_3}$	0	$-\frac{2ikt_1-4ikt_3}{3t_1t_3+6k^2t_1t_3}$
$\sigma_{1-}^{\#2} \dagger^\alpha$	0	0	0	$\frac{t_1+4t_3}{3(1+2k^2)^2t_1t_3}$	0	$\frac{i\sqrt{2}k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$
$\tau_{1-}^{\#1} \dagger^\alpha$	0	0	0	0	0	0
$\tau_{1-}^{\#2} \dagger^\alpha$	0	0	0	$\frac{2ik(t_1-2t_3)}{3t_1t_3+6k^2t_1t_3}$	$-\frac{i\sqrt{2}k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$	$\frac{2k^2(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$

$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2}$	$f_{1+}^{\#1}$	$\omega_{1-}^{\#1}$	$\omega_{1-}^{\#2}$	$f_{1-}^{\#1}$	$f_{1-}^{\#2}$
$k^2r_1-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{ikt_1}{\sqrt{2}}$	0	0	0	0
$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\frac{ikt_1}{\sqrt{2}}$	0	0	0	0	0	0
0	0	0	$\frac{1}{6}(t_1+4t_3)$	$\frac{t_1-2t_3}{3\sqrt{2}}$	0	$\frac{1}{3}ik(t_1-2t_3)$
0	0	0	$\frac{t_1-2t_3}{3\sqrt{2}}$	$\frac{t_1+t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}k(t_1+t_3)$
0	0	0	0	0	0	0
0	0	0	$-\frac{1}{3}ik(t_1-2t_3)$	$-\frac{1}{3}i\sqrt{2}k(t_1+t_3)$	0	$\frac{2}{3}k^2(t_1+t_3)$

$\sigma_{0+}^{\#1} \dagger$	$\sigma_{0+}^{\#1}$	$\tau_{0+}^{\#1} \dagger$	$\sigma_{0+}^{\#2}$	$\tau_{0+}^{\#1}$	$\tau_{0+}^{\#2}$	$\sigma_{0+}^{\#1}$
0	t_3	$i\sqrt{2}kt_3$	0	0	0	0
$\tau_{0+}^{\#1} \dagger$	0	0	0	0	0	0
$\tau_{0+}^{\#2} \dagger$	0	0	0	0	0	0
$\omega_{0+}^{\#1} \dagger$	0	0	0	0	0	$-t_1$

$\sigma_{0+}^{\#1} \dagger$	$\sigma_{0+}^{\#1}$	$\tau_{0+}^{\#1} \dagger$	$\tau_{0+}^{\#2}$	$\sigma_{0+}^{\#1}$
$\frac{1}{(1+2k^2)^2t_3}$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	0	0	0
$\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	$\frac{2k^2}{(1+2k^2)^2t_3}$	0	0	0
0	0	0	0	0
0	0	0	0	$-\frac{1}{t_1}$

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

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