

Wave operator and propagator

SO(3) irreps	Fundamental fields	Multiplicities
$\sigma_{0-}^{\#1} == 0$	$\epsilon \eta_{\alpha\beta\chi\delta} \partial^\delta \sigma^{\alpha\beta\chi} == 0$	1
$\tau_{0+}^{\#2} == 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} == 0$	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
$\tau_1^{\#1\alpha} == 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} == \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	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
$\tau_2^{\#1\alpha\beta} - 2 i k \sigma_2^{\#1\alpha\beta} == 0$	$-i (4 \partial_\delta \partial_\chi \partial^\beta \partial^\alpha \tau^{\chi\delta} + 2 \partial_\delta \partial^\delta \partial^\beta \partial^\alpha \tau^\chi_\chi -$ $3 \partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\beta\chi} - 3 \partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\chi\beta} -$ $3 \partial_\delta \partial^\delta \partial_\chi \partial^\beta \tau^{\alpha\chi} - 3 \partial_\delta \partial^\delta \partial_\chi \partial^\beta \tau^{\chi\alpha} +$ $3 \partial_\delta \partial^\delta \partial_\chi \partial^\chi \tau^{\alpha\beta} + 3 \partial_\delta \partial^\delta \partial_\chi \partial^\chi \tau^{\beta\alpha} +$ $4 i k^\chi \partial_\epsilon \partial_\chi \partial^\beta \partial^\alpha \sigma^{\delta\epsilon}_\delta -$ $6 i k^\chi \partial_\epsilon \partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\delta\epsilon} -$ $6 i k^\chi \partial_\epsilon \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\delta\epsilon} +$ $2 \eta^{\alpha\beta} \partial_\epsilon \partial^\epsilon \partial_\delta \partial_\chi \tau^{\chi\delta} +$ $6 i k^\chi \partial_\epsilon \partial^\epsilon \partial_\delta \partial_\chi \sigma^{\alpha\delta\beta} +$ $6 i k^\chi \partial_\epsilon \partial^\epsilon \partial_\delta \partial_\chi \sigma^{\beta\delta\alpha} -$ $2 \eta^{\alpha\beta} \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \tau^\chi_\chi -$ $4 i \eta^{\alpha\beta} k^\chi \partial_\phi \partial^\phi \partial_\epsilon \partial_\chi \sigma^{\delta\epsilon}_\delta) == 0$	5
Total constraints/gauge generators:		17

$\sigma_1^{\#1} + \alpha\beta$	$\frac{1}{k^2(2r_1+r_5)}$	$\frac{1}{\sqrt{2}(k^2+k^4)(2r_1+r_5)}$	$\frac{i}{\sqrt{2}(k+k^3)(2r_1+r_5)}$	$\sigma_1^{\#1} \alpha$	$\sigma_1^{\#2} \alpha$	$\tau_1^{\#1} \alpha$	$\tau_1^{\#2} \alpha$
$\sigma_1^{\#2} + \alpha\beta$	$\frac{1}{\sqrt{2}(k^2+k^4)(2r_1+r_5)}$	$\frac{6k^2(2r_1+r_5)+t_1}{2(k+k^3)^2(2r_1+r_5)t_1}$	$\frac{i(6k^2(2r_1+r_5)+t_1)}{2k(1+k^2)^2(2r_1+r_5)t_1}$	0	0	0	0
$\tau_1^{\#1} + \alpha\beta$	$-\frac{i}{\sqrt{2}(k+k^3)(2r_1+r_5)}$	$-\frac{i(6k^2(2r_1+r_5)+t_1)}{2k(1+k^2)^2(2r_1+r_5)t_1}$	$\frac{6k^2(2r_1+r_5)+t_1}{2(1+k^2)^2(2r_1+r_5)t_1}$	0	0	0	0
$\sigma_1^{\#1} + \alpha$	0	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2t_1}$	0	$\frac{2ik}{t_1+2k^2t_1}$
$\sigma_1^{\#2} + \alpha$	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2t_1}$	$\frac{-2k^2(r_1+r_5)+t_1}{(t_1+2k^2t_1)^2}$	0	$-\frac{i\sqrt{2}k(2k^2(r_1+r_5)+t_1)}{(t_1+2k^2t_1)^2}$
$\tau_1^{\#1} + \alpha$	0	0	0	0	0	0	0
$\tau_1^{\#2} + \alpha$	0	0	0	$-\frac{2ik}{t_1+2k^2t_1}$	$\frac{i\sqrt{2}k(2k^2(r_1+r_5)+t_1)}{(t_1+2k^2t_1)^2}$	0	$\frac{-4k^4(r_1+r_5)+2k^2t_1}{(t_1+2k^2t_1)^2}$

Quadratic (free) action

$$\begin{aligned}
 S = & \iiint \left(\frac{1}{3} (3t_1 \omega^{\alpha\iota} \omega^{\theta}_{\theta} + 3 f^{\alpha\beta} \tau_{\alpha\beta} + 3 \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} - 6t_1 \omega^{\theta}_{\alpha} \omega^{\theta}_{\theta} \partial_{\iota} f^{\alpha\iota} + \right. \\
 & 6t_1 \omega^{\theta}_{\iota} \omega^{\theta}_{\theta} \partial_{\iota} f^{\alpha}_{\alpha} - 3t_1 \partial_{\iota} f^{\theta}_{\theta} \partial_{\theta} f^{\alpha}_{\alpha} - 3t_1 \partial_{\iota} f^{\alpha\iota} \partial_{\theta} f^{\theta}_{\alpha} + \\
 & 6t_1 \partial_{\iota} f^{\alpha}_{\alpha} \partial_{\theta} f^{\theta}_{\iota} + 2t_1 \omega_{\theta\alpha} \partial^{\theta} f^{\alpha\iota} - 2t_1 \partial_{\alpha} f_{\theta} \partial^{\theta} f^{\alpha\iota} - \\
 & 2t_1 \partial_{\alpha} f_{\theta\iota} \partial^{\theta} f^{\alpha\iota} + t_1 \partial_{\iota} f_{\alpha\theta} \partial^{\theta} f^{\alpha\iota} + 2t_1 \partial_{\theta} f_{\alpha\iota} \partial^{\theta} f^{\alpha\iota} + \\
 & t_1 \partial_{\theta} f_{\alpha} \partial^{\theta} f^{\alpha\iota} + t_1 \omega_{\alpha\iota\theta} (\omega^{\alpha\iota\theta} + 2 \partial^{\theta} f^{\alpha\iota}) + \\
 & t_1 \omega_{\alpha\theta\iota} (\omega^{\alpha\iota\theta} + 4 \partial^{\theta} f^{\alpha\iota}) - 4 r_1 \partial_{\beta} \omega_{\alpha\iota\theta} \partial^{\theta} \omega^{\alpha\beta\iota} + \\
 & 2 r_1 \partial_{\beta} \omega_{\alpha\theta\iota} \partial^{\theta} \omega^{\alpha\beta\iota} - 8 r_1 \partial_{\beta} \omega_{\iota\theta\alpha} \partial^{\theta} \omega^{\alpha\beta\iota} - \\
 & 2 r_1 \partial_{\iota} \omega_{\alpha\beta\theta} \partial^{\theta} \omega^{\alpha\beta\iota} + 2 r_1 \partial_{\theta} \omega_{\alpha\beta\iota} \partial^{\theta} \omega^{\alpha\beta\iota} + \\
 & 2 r_1 \partial_{\theta} \omega_{\alpha\iota\beta} \partial^{\theta} \omega^{\alpha\beta\iota} + 3 r_5 \partial_{\iota} \omega^{\kappa}_{\kappa} \partial^{\theta} \omega^{\alpha\iota}_{\alpha} - \\
 & 3 r_5 \partial_{\theta} \omega^{\kappa}_{\iota} \omega^{\alpha\iota}_{\alpha} - 3 r_5 \partial_{\alpha} \omega^{\alpha\iota\theta} \partial_{\kappa} \omega^{\kappa}_{\iota\theta} + \\
 & 6 r_5 \partial^{\theta} \omega^{\alpha\iota}_{\alpha} \partial_{\kappa} \omega^{\kappa}_{\iota\theta} + 3 r_5 \partial_{\alpha} \omega^{\alpha\iota\theta} \partial_{\kappa} \omega^{\kappa}_{\theta\iota} - \\
 & \left. 6 r_5 \partial^{\theta} \omega^{\alpha\iota}_{\alpha} \partial_{\kappa} \omega^{\kappa}_{\theta\iota} \right) [t, x, y, z] dz dy dx dt
 \end{aligned}$$

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

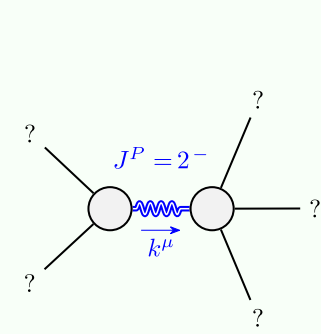
	$\sigma_{2^+}^{\#1} \alpha\beta$	$\tau_{2^+}^{\#1} \alpha\beta$	$\sigma_{2^-}^{\#1} \alpha\beta\chi$
$\sigma_{2^+}^{\#1} \dagger \alpha\beta$	$\frac{2}{(1+2k^2)^2 t_1}$	$-\frac{2i\sqrt{2}k}{(1+2k^2)^2 t_1}$	0
$\tau_{2^+}^{\#1} \dagger \alpha\beta$	$\frac{2i\sqrt{2}k}{(1+2k^2)^2 t_1}$	$\frac{4k^2}{(1+2k^2)^2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

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

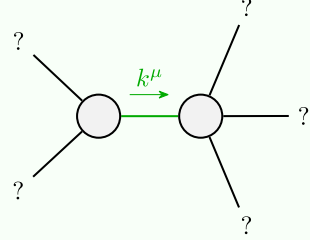
	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^+}^{\#1}$
$\omega_{0^+}^{\#1} \dagger$	$-t_1$	$i \sqrt{2} k t_1$	0	0
$f_{0^+}^{\#1} \dagger$	$-i \sqrt{2} k t_1$	$-2 k^2 t_1$	0	0
$f_{0^+}^{\#2} \dagger$	0	0	0	0
$\omega_{0^+}^{\#1} \dagger$	0	0	0	0

$\omega_1^{\#1} + \alpha\beta$	$\kappa^2 (2r_1 + r_5) + \frac{t_1}{6}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3\sqrt{2}}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$\omega_1^{\#2} + \alpha\beta$	$-\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	$\frac{t_1}{3}$	$\frac{ikt_1}{3}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$f_1^{\#1} + \alpha\beta$	$\frac{ikt_1}{3\sqrt{2}}$	$-\frac{1}{3} ikt_1$	$-\frac{1}{3} ikt_1$	$\frac{\kappa^2 t_1}{3}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$\omega_1^{\#1} + \alpha$	$\kappa^2 (2r_1 + r_5) + \frac{t_1}{6}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3\sqrt{2}}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$\omega_1^{\#2} + \alpha$	$-\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	$\frac{t_1}{3}$	$\frac{ikt_1}{3}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$f_1^{\#1} + \alpha$	$\frac{ikt_1}{3\sqrt{2}}$	$-\frac{1}{3} ikt_1$	$-\frac{1}{3} ikt_1$	$\frac{\kappa^2 t_1}{3}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$
$f_1^{\#2} + \alpha$	$\kappa^2 (2r_1 + r_5) + \frac{t_1}{6}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3\sqrt{2}}$	$\omega_1^{\#1} + \alpha$	$\omega_1^{\#2} + \alpha$	$f_1^{\#1} + \alpha$	$f_1^{\#2} + \alpha$

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



Quadratic pole	
Pole residue:	$\frac{1}{(2r_1+r_5)t_1^2 p^2} > 0$
Polarisations:	2

Unitarity conditions

$$r_1 < 0 \ \&\& \ r_5 > -2r_1 \ \&\& \ t_1 > 0$$