



Massive particle	
Pole residue:	$-\frac{1}{\sqrt{2}} \vee 0$
Polarisations:	1
Square mass:	$-\frac{t_2}{\sqrt{2}} \vee 0$
Spin:	0
Parity:	Odd

$r_2 < 0$  &  $t_2 > 0$

Unitarity conditions

(No massless particles)

Lagrangian density

$$\begin{aligned} &\frac{2}{3}t_3\omega_{\lambda'}^{\alpha'}\omega_{\kappa\alpha}^{\kappa}+\frac{2}{3}t_2\omega_{\lambda'}^{\kappa\lambda}\omega_{\kappa\lambda'}^{\lambda}+\frac{1}{3}t_2\omega_{\kappa\lambda}^{\lambda'}\omega_{\lambda'}^{\kappa\lambda}+ \\ &\frac{3}{2}r_3\partial_{\lambda}\omega_{\kappa}^{\kappa\lambda}\partial'_{\omega_{\lambda}\alpha}{}^{\alpha}+\frac{2}{3}r_2\partial^{\beta}\omega_{\kappa}^{\theta\alpha}\partial_{\theta}\omega_{\alpha\beta}^{\kappa}-\frac{1}{3}r_2\partial_{\theta}\omega_{\alpha\beta}^{\kappa}\partial_{\kappa}\omega^{\alpha\beta\theta}- \\ &\frac{2}{3}r_2\partial_{\theta}\omega_{\alpha\beta}^{\kappa}\partial_{\kappa}\omega^{\theta\alpha\beta}+\frac{5}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\theta}\omega_{\lambda}^{\theta\kappa\lambda}-\frac{5}{2}r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\theta\kappa\lambda}+ \\ &\frac{3}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}-3r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}+\frac{1}{6}t_2\partial^{\alpha}f_{\theta\kappa}\partial^{\kappa}f_{\alpha}{}^{\theta}- \\ &\frac{1}{6}t_2\partial^{\alpha}f_{\kappa\theta}\partial^{\kappa}f_{\alpha}{}^{\theta}+\frac{1}{6}t_2\partial^{\alpha}f_{\kappa}^{\lambda}\partial^{\kappa}f_{\alpha\lambda}{}^{-\frac{2}{3}}t_3\omega_{\kappa\alpha}^{\alpha}\partial^{\kappa}f_{\lambda'}^{\lambda}- \\ &\frac{2}{3}t_3\omega_{\kappa\lambda}^{\lambda}\partial^{\kappa}f_{\lambda'}^{\lambda}-\frac{4}{3}t_3\partial^{\alpha}f_{\kappa\alpha}\partial^{\kappa}f_{\lambda'}^{\lambda}+\frac{2}{3}t_3\partial_{\kappa}f_{\lambda}^{\lambda}\partial^{\kappa}f_{\lambda'}^{\lambda}+\frac{1}{3}t_2\omega_{\theta\kappa}\partial^{\kappa}f^{\theta}- \\ &\frac{2}{3}t_2\omega_{\kappa\theta}\partial^{\kappa}f^{\theta}-\frac{1}{3}t_2\omega_{\theta\kappa}\partial^{\kappa}f^{\theta}+\frac{2}{3}t_2\omega_{\theta\kappa\lambda}\partial^{\kappa}f^{\theta}+\frac{2}{3}t_3\omega_{\lambda\alpha}\partial^{\kappa}f_{\lambda'}^{\lambda}+ \\ &\frac{2}{3}t_3\omega_{\lambda\lambda}^{\lambda}\partial^{\kappa}f_{\kappa}^{\lambda}-\frac{1}{6}t_2\partial^{\alpha}f_{\kappa}^{\lambda}\partial^{\kappa}f_{\lambda\alpha}{}^{-\frac{1}{6}}t_2\partial_{\kappa}f_{\theta}^{\lambda}\partial^{\kappa}f_{\lambda}^{\theta}+ \\ &\frac{1}{6}t_2\partial_{\kappa}f_{\theta}^{\lambda}\partial^{\kappa}f_{\lambda}^{\theta}+\frac{2}{3}t_3\partial^{\alpha}f_{\alpha}^{\lambda}\partial^{\kappa}f_{\lambda\kappa}{}^{\lambda}+\frac{1}{3}r_2\partial_{\kappa}\omega^{\alpha\beta\theta}\partial^{\kappa}\omega_{\alpha\beta\theta}+ \\ &\frac{2}{3}r_2\partial_{\kappa}\omega^{\theta\alpha\beta}\partial^{\kappa}\omega_{\alpha\beta\theta}-\frac{2}{3}r_2\partial^{\beta}\omega_{\lambda'}^{\alpha\lambda}\partial_{\lambda}\omega_{\alpha\beta}^{\lambda}+\frac{2}{3}r_2\partial^{\beta}\omega_{\lambda'}^{\lambda\alpha}\partial_{\lambda}\omega_{\alpha\beta}^{\lambda}- \\ &4r_3\partial^{\beta}\omega_{\lambda'}^{\lambda\alpha}\partial_{\lambda}\omega_{\alpha\beta}^{\lambda}-\frac{5}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa}+\frac{5}{2}r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa} \end{aligned}$$

Added source term:  $f^{\alpha\beta}\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi}$

	$\sigma_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1+}^{\#2} \dagger^{\alpha\beta}$	$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1-}^{\#1} \dagger^{\alpha}$	$\sigma_{1-}^{\#2} \dagger^{\alpha}$	$\tau_{1-}^{\#1} \dagger^{\alpha}$	$\tau_{1-}^{\#2} \dagger^{\alpha}$
$\sigma_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{6}{(3+k^2)^2}t_2$	$\frac{3\sqrt{2}}{(3+k^2)^2}t_2$	$\frac{3i\sqrt{2}k}{(3+k^2)^2}t_2$	0	0	0	0
$\sigma_{1+}^{\#2} \dagger^{\alpha\beta}$	$\frac{3\sqrt{2}}{(3+k^2)^2}t_2$	$\frac{3}{(3+k^2)^2}t_2$	$\frac{3ik}{(3+k^2)^2}t_2$	0	0	0	0
$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{3i\sqrt{2}k}{(3+k^2)^2}t_2$	$-\frac{3ik}{(3+k^2)^2}t_2$	$\frac{3k^2}{(3+k^2)^2}t_2$	0	0	0	0
$\sigma_{1-}^{\#1} \dagger^{\alpha}$	0	0	0	$-\frac{2}{3k^2}r_3$	$-\frac{2\sqrt{2}}{3k^2}r_3+6k^4r_3$	0	$-\frac{4i}{3kr_3+6k^3}r_3$
$\sigma_{1-}^{\#2} \dagger^{\alpha}$	0	0	0	$-\frac{2\sqrt{2}}{3k^2}r_3+6k^4r_3$	$\frac{9k^2r_3-4t_3}{3(k+2k^3)^2}r_3t_3$	0	$\frac{i\sqrt{2}(9k^2r_3-4t_3)}{3k(1+2k^2)^2}r_3t_3$
$\tau_{1-}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1-}^{\#2} \dagger^{\alpha}$	0	0	0	$\frac{4i}{3kr_3+6k^3}r_3$	$-\frac{i\sqrt{2}(9k^2r_3-4t_3)}{3k(1+2k^2)^2}r_3t_3$	0	$\frac{2(9k^2r_3-4t_3)}{3(1+2k^2)^2}r_3t_3$

	$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2} \dagger^{\alpha\beta}$	$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1-}^{\#1} \dagger^{\alpha}$	$\omega_{1-}^{\#2} \dagger^{\alpha}$	$f_{1-}^{\#1} \dagger^{\alpha}$	$f_{1-}^{\#2} \dagger^{\alpha}$
$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{2t_2}{3}$	$\frac{\sqrt{2}t_2}{3}$	$\frac{1}{3}i\sqrt{2}kt_2$	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
$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{1}{3}i\sqrt{2}kt_2$	$-\frac{1}{3}ikt_2$	$\frac{k^2t_2}{3}$	0	0	0	0
$\omega_{1-}^{\#1} \dagger^{\alpha}$	0	0	0	$\frac{1}{6}(-9k^2r_3+4t_3)$	$-\frac{\sqrt{2}t_3}{3}$	0	$-\frac{2}{3}ikt_3$
$\omega_{1-}^{\#2} \dagger^{\alpha}$	0	0	0	$-\frac{\sqrt{2}t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}kt_3$
$f_{1-}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0	0
$f_{1-}^{\#2} \dagger^{\alpha}$	0	0	0	$\frac{2ikt_3}{3}$	$-\frac{1}{3}i\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$

Source constraints

SO(3) irreps	#
$\tau_{0+}^{\#2} == 0$	1
$\tau_{0+}^{\#1} - 2ik\sigma_{0+}^{\#1} == 0$	1
$\tau_{1-}^{\#2\alpha} + 2ik\sigma_{1-}^{\#2\alpha} == 0$	3
$\tau_{1-}^{\#1\alpha} == 0$	3
$\tau_{1+}^{\#1\alpha\beta} + ik\sigma_{1+}^{\#1\alpha\beta} == 0$	3
$\sigma_{1+}^{\#1\alpha\beta} == \sigma_{1+}^{\#2\alpha\beta}$	3
$\sigma_{2-}^{\#1\alpha\beta\chi} == 0$	5
$\tau_{2+}^{\#1\alpha\beta} == 0$	5
Total #:	24

	$\omega_{0+}^{\#1}$	$f_{0+}^{\#1}$	$f_{0+}^{\#2}$	$\omega_{0-}^{\#1}$
$\omega_{0+}^{\#1} \dagger$	$t_3$	$-i\sqrt{2}kt_3$	0	0
$f_{0+}^{\#1} \dagger$	$i\sqrt{2}kt_3$	$2k^2t_3$	0	0
$f_{0+}^{\#2} \dagger$	0	0	0	0
$\omega_{0-}^{\#1} \dagger$	0	0	0	$k^2r_2+t_2$

	$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{2}{3k^2}r_3$	0	0
$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0

	$\omega_{2+}^{\#1} \dagger^{\alpha\beta}$	$f_{2+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
$\omega_{2+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{3k^2r_3}{2}$	0	0
$f_{2+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\omega_{2-}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0

	$\sigma_{0+}^{\#1}$	$\tau_{0+}^{\#2}$	$\sigma_{0-}^{\#1}$
$\sigma_{0+}^{\#1} \dagger$	$\frac{1}{(1+2k^2)^2}t_3$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2}t_3$	0
$\tau_{0+}^{\#1} \dagger$	$\frac{i\sqrt{2}k}{(1+2k^2)^2}t_3$	$\frac{2k^2}{(1+2k^2)^2}t_3$	0
$\tau_{0+}^{\#2} \dagger$	0	0	0
$\sigma_{0-}^{\#1} \dagger$	0	0	$\frac{1}{k^2r_2+t_2}$