



$$r_3 < 0 \&\& (r_5 < -\frac{r_3}{2} \parallel r_5 > -2r_3) \parallel r_3 > 0 \&\& -2r_3 < r_5 < -\frac{r_3}{2}$$

Quadratic pole

Pole residue:	$-\frac{1}{r_3(2r_3+r_5)(r_3+2r_5)p^2} > 0$
Polarisations:	2

(No massive particles)

$\sigma_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1^+}^{\#2}$	$\tau_{1^+}^{\#1}$	$\sigma_{1^+}^{\#1}$	$\sigma_{1^+}^{\#2}$	$\tau_{1^+}^{\#1}$	$\tau_{1^+}^{\#2}$
$\sigma_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\frac{1}{k^2(2r_3+r_5)}$	$-\frac{\sqrt{2}}{k^2(1+k^2)(2r_3+r_5)}$	$-\frac{i\sqrt{2}}{k(1+k^2)(2r_3+r_5)}$	0	0	0
$\sigma_{1^+}^{\#2} \dagger^{\alpha\beta}$	$-\frac{\sqrt{2}}{k^2(1+k^2)(2r_3+r_5)}$	$\frac{3k^2(2r_3+r_5)+2t_2}{(k+k^3)^2(2r_3+r_5)t_2}$	$\frac{i(3k^2(2r_3+r_5)+2t_2)}{k(1+k^2)^2(2r_3+r_5)t_2}$	0	0	0
$\tau_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\frac{i\sqrt{2}}{k(1+k^2)(2r_3+r_5)}$	$-\frac{i(3k^2(2r_3+r_5)+2t_2)}{k(1+k^2)^2(2r_3+r_5)t_2}$	$\frac{3k^2(2r_3+r_5)+2t_2}{(1+k^2)^2(2r_3+r_5)t_2}$	0	0	0
$\sigma_{1^+}^{\#1} \dagger^\alpha$	0	0	$\frac{2}{k^2(r_3+2r_5)}$	0	0	0
$\sigma_{1^+}^{\#2} \dagger^\alpha$	0	0	0	0	0	0
$\tau_{1^+}^{\#1} \dagger^\alpha$	0	0	0	0	0	0
$\tau_{1^+}^{\#2} \dagger^\alpha$	0	0	0	0	0	0

$\omega_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1^+}^{\#2}$	$f_{1^+}^{\#1}$	$\omega_{1^+}^{\#1}$	$\omega_{1^+}^{\#2}$	$f_{1^+}^{\#1}$	$f_{1^+}^{\#2}$
$\omega_{1^+}^{\#1} \dagger^{\alpha\beta}$	$k^2(2r_3+r_5) + \frac{2t_2}{3}$	$\frac{\sqrt{2}t_2}{3}$	$\frac{1}{3}i\sqrt{2}kt_2$	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
$f_{1^+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{1}{3}i\sqrt{2}kt_2$	$-\frac{1}{3}i kt_2$	$\frac{k^2t_2}{3}$	0	0	0
$\omega_{1^+}^{\#1} \dagger^\alpha$	0	0	$\frac{1}{2}k^2(r_3+2r_5)$	0	0	0
$\omega_{1^+}^{\#2} \dagger^\alpha$	0	0	0	0	0	0
$f_{1^+}^{\#1} \dagger^\alpha$	0	0	0	0	0	0
$f_{1^+}^{\#2} \dagger^\alpha$	0	0	0	0	0	0

### Lagrangian density

$$\begin{aligned} &\frac{2}{3}t_2\omega_{\lambda'}^{\kappa\lambda}\omega_{\kappa\lambda'}^{\prime}+\frac{1}{3}t_2\omega_{\kappa\lambda}^{\prime}\omega_{\lambda'}^{\kappa\lambda}+f^{\alpha\beta}\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi}^{\prime}-\frac{1}{2}r_3\partial_{\lambda'}\omega_{\kappa}^{\kappa\lambda}\partial^{\prime}\omega_{\lambda}^{\alpha}- \\ &r_5\partial_{\lambda'}\omega_{\kappa}^{\kappa\lambda}\partial^{\prime}\omega_{\lambda}^{\alpha}+\frac{1}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\theta}\omega_{\lambda}^{\theta\kappa\lambda}-r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\theta\kappa\lambda}-\frac{1}{2}r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\theta\kappa\lambda}+ \\ &r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\theta\kappa\lambda}-\frac{1}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\theta}\omega_{\lambda}^{\kappa\lambda\theta}-r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\kappa\lambda\theta}+r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\kappa\lambda\theta}+ \\ &2r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\lambda}^{\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_{\lambda}^{\theta}\partial^{\kappa}f_{\alpha}^{\lambda}+\frac{1}{6}t_2\partial^{\alpha}f_{\lambda}^{\prime}\partial^{\kappa}f_{\alpha\lambda}^{\prime}+ \\ &\frac{1}{3}t_2\omega_{\theta\kappa}\partial^{\kappa}f^{\prime\theta}-\frac{2}{3}t_2\omega_{\lambda\kappa\theta}\partial^{\kappa}f^{\prime\theta}-\frac{1}{3}t_2\omega_{\theta\lambda\kappa}\partial^{\kappa}f^{\prime\theta}+\frac{2}{3}t_2\omega_{\theta\kappa\lambda}\partial^{\kappa}f^{\prime\theta}+\frac{2}{3}t_2\omega_{\theta\kappa\lambda}\partial^{\kappa}f^{\prime\theta}- \\ &\frac{1}{6}t_2\partial^{\alpha}f_{\lambda}^{\lambda}\partial^{\kappa}f_{\kappa\alpha}^{\lambda}-\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}-4r_3\partial^{\beta}\omega_{\lambda}^{\prime\lambda\alpha}\partial_{\lambda}\omega_{\alpha\beta}^{\prime}- \\ &\frac{1}{2}r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\theta}^{\theta\kappa}+r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\theta}^{\theta\kappa}+\frac{1}{2}r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa}-r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa} \end{aligned}$$

### Source constraints

SO(3) irreps	#
$\sigma_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{1^+}^{\#2\alpha} == 0$	3
$\tau_{1^+}^{\#1\alpha} == 0$	3
$\sigma_{1^+}^{\#2\alpha} == 0$	3
$\tau_{1^+}^{\#1\alpha\beta} + i k \sigma_{1^+}^{\#2\alpha\beta} == 0$	3
$\sigma_{2^+}^{\#1\alpha\beta\chi} == 0$	5
$\tau_{2^+}^{\#1\alpha\beta} == 0$	5
Total #:	25

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

$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^+}^{\#1}$
$\sigma_{0^+}^{\#1} \dagger$	0	0	0
$\tau_{0^+}^{\#1} \dagger$	0	0	0
$\tau_{0^+}^{\#2} \dagger$	0	0	0
$\sigma_{0^+}^{\#1} \dagger$	0	0	$\frac{1}{t_2}$

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

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