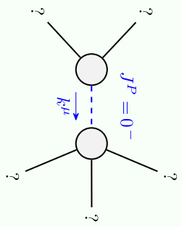
$r_2 < 0 \;\&\&\; t_2 > 0$




| 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)

## Lagrangian density

$$\frac{2}{3} t_2\, \omega_{\iota}^{\kappa\lambda}\, \omega_{\kappa\lambda}{}' + \frac{1}{3} t_2\, \omega_{\kappa\lambda}{}'\, \omega^{\kappa\lambda}{}_{\iota} + f^{\alpha\beta}\, \tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\, \sigma_{\alpha\beta\chi} - r_3\, \partial_\iota \omega^{\kappa\lambda}{}_{\kappa} \partial^\iota \omega_\lambda{}^\alpha{}_\alpha +$$
$$\frac{2}{3} r_2\, \partial^\beta \omega^{\theta\alpha}{}_{\kappa} \partial_\theta \omega_{\alpha\beta}{}^{\kappa} - \frac{1}{3} r_2\, \partial_\theta \omega_{\alpha\beta}{}^{\kappa} \partial_\kappa \omega^{\alpha\beta\theta} - \frac{2}{3} r_2\, \partial_\theta \omega_{\alpha\beta}{}^{\kappa} \partial_\kappa \omega^{\theta\alpha\beta} +$$
$$3 r_3\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial_\kappa \omega^{\theta\kappa\lambda} - 3 r_3\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial_\kappa \omega^{\theta\kappa\lambda} - r_3\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial_\kappa \omega^{\kappa\lambda\theta} +$$
$$2 r_3\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial_\kappa \omega^{\kappa\lambda\theta} + \frac{1}{6} t_2\, \partial^\alpha f_{\theta\kappa} \partial^\kappa f_\alpha{}^\theta - \frac{1}{6} t_2\, \partial^\alpha f_{\kappa\theta} \partial^\kappa f_\alpha{}^\theta + \frac{1}{6} t_2\, \partial^\alpha f^\lambda{}_\kappa \partial^\kappa f_{\alpha\lambda} +$$
$$\frac{1}{3} t_2\, \omega_{\iota\theta\kappa} \partial^\kappa f^{\iota\theta} - \frac{2}{3} t_2\, \omega_{\iota\kappa\theta} \partial^\kappa f^{\iota\theta} - \frac{1}{3} t_2\, \omega_{\theta\iota\kappa} \partial^\kappa f^{\iota\theta} + \frac{2}{3} t_2\, \omega_{\theta\kappa\iota} \partial^\kappa f^{\iota\theta} -$$
$$\frac{1}{6} t_2\, \partial^\alpha f^\lambda{}_\kappa \partial^\kappa f_{\lambda\alpha} - \frac{1}{6} t_2\, \partial_\kappa f_\theta{}^\lambda \partial^\kappa f_\lambda{}^\theta + \frac{1}{6} t_2\, \partial_\kappa f^\lambda{}_\theta \partial^\kappa f_\lambda{}^\theta + \frac{1}{3} r_2\, \partial_\kappa \omega^{\alpha\beta\theta} \partial^\kappa \omega_{\alpha\beta\theta} +$$
$$\frac{2}{3} r_2\, \partial_\kappa \omega^{\theta\alpha\beta} \partial^\kappa \omega_{\alpha\beta\theta} - \frac{2}{3} r_2\, \partial^\beta \omega_{\iota}^{\alpha\lambda} \partial_\lambda \omega_{\alpha\beta}{}' + \frac{2}{3} r_2\, \partial^\beta \omega_{\iota}^{\lambda\alpha} \partial_\lambda \omega_{\alpha\beta}{}' -$$
$$4 r_3\, \partial^\beta \omega_{\iota}^{\lambda\alpha} \partial_\lambda \omega_{\alpha\beta}{}' - 3 r_3\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial^\lambda \omega^{\theta\kappa}{}_{\kappa} + 3 r_3\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial^\lambda \omega^{\theta\kappa}{}_{\kappa}$$

| | $\sigma_{1^+}^{\#1}{}_{\alpha\beta}$ | $\sigma_{1^+}^{\#2}{}_{\alpha\beta}$ | $\tau_{1^+}^{\#1}{}_{\alpha\beta}$ | $\sigma_{1^-}^{\#1}{}_{\alpha}$ | $\sigma_{1^-}^{\#2}{}_{\alpha}$ | $\tau_{1^-}^{\#1}{}_{\alpha}$ | $\tau_{1^-}^{\#2}{}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $\sigma_{1^+}^{\#1}\,\dagger^{\alpha\beta}$ | $\frac{1}{k^2 r_3}$ | $-\frac{\sqrt{2}}{k^2 r_3 + k^4 r_3}$ | $-\frac{i\sqrt{2}}{k r_3 + k^3 r_3}$ | 0 | 0 | 0 | 0 |
| $\sigma_{1^+}^{\#2}\,\dagger^{\alpha\beta}$ | $-\frac{\sqrt{2}}{k^2 r_3 + k^4 r_3}$ | $\frac{3k^2 r_3 + 2t_2}{(k+k^3)^2 r_3 t_2}$ | $\frac{i(3k^2 r_3 + 2t_2)}{k(1+k^2)^2 r_3 t_2}$ | 0 | 0 | 0 | 0 |
| $\tau_{1^+}^{\#1}\,\dagger^{\alpha\beta}$ | $\frac{i\sqrt{2}}{k r_3 + k^3 r_3}$ | $-\frac{i(3k^2 r_3 + 2t_2)}{k(1+k^2)^2 r_3 t_2}$ | $\frac{3k^2 r_3 + 2t_2}{(1+k^2)^2 r_3 t_2}$ | 0 | 0 | 0 | 0 |
| $\sigma_{1^-}^{\#1}\,\dagger^{\alpha}$ | 0 | 0 | 0 | $\frac{1}{k^2 r_3}$ | 0 | 0 | 0 |
| $\sigma_{1^-}^{\#2}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $\tau_{1^-}^{\#1}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $\tau_{1^-}^{\#2}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | $\omega_{1^+}^{\#1}{}_{\alpha\beta}$ | $\omega_{1^+}^{\#2}{}_{\alpha\beta}$ | $f_{1^+}^{\#1}{}_{\alpha\beta}$ | $\omega_{1^-}^{\#1}{}_{\alpha}$ | $\omega_{1^-}^{\#2}{}_{\alpha}$ | $f_{1^-}^{\#1}{}_{\alpha}$ | $f_{1^-}^{\#2}{}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $\omega_{1^+}^{\#1}\,\dagger^{\alpha\beta}$ | $k^2 r_3 + \frac{2t_2}{3}$ | $\frac{\sqrt{2}\, t_2}{3}$ | $\frac{1}{3} i \sqrt{2}\, k t_2$ | 0 | 0 | 0 | 0 |
| $\omega_{1^+}^{\#2}\,\dagger^{\alpha\beta}$ | $\frac{\sqrt{2}\, t_2}{3}$ | $\frac{t_2}{3}$ | $\frac{i k t_2}{3}$ | 0 | 0 | 0 | 0 |
| $f_{1^+}^{\#1}\,\dagger^{\alpha\beta}$ | $-\frac{1}{3} i \sqrt{2}\, k t_2$ | $-\frac{1}{3} i k t_2$ | $\frac{k^2 t_2}{3}$ | 0 | 0 | 0 | 0 |
| $\omega_{1^-}^{\#1}\,\dagger^{\alpha}$ | 0 | 0 | 0 | $k^2 r_3$ | 0 | 0 | 0 |
| $\omega_{1^-}^{\#2}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $f_{1^-}^{\#1}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $f_{1^-}^{\#2}\,\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Source constraints | | |
|---|---|---|
| SO(3) irreps | # | Total #: |
| $\tau_{0^+}^{\#2} == 0$ | 1 | 29 |
| $\tau_{0^+}^{\#1} == 0$ | 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 | |
| $\sigma_{2^+}^{\#1\alpha\beta} == 0$ | 5 | |

| | $\sigma_{0^+}^{\#1}\,\dagger$ | $\tau_{0^+}^{\#1}\,\dagger$ | $\tau_{0^+}^{\#2}\,\dagger$ | $\sigma_{0^-}^{\#1}\,\dagger$ |
|---|---|---|---|---|
| $\sigma_{0^+}^{\#1}$ | $\frac{1}{6k^2 r_3}$ | 0 | 0 | 0 |
| $\tau_{0^+}^{\#1}$ | 0 | 0 | 0 | 0 |
| $\tau_{0^+}^{\#2}$ | 0 | 0 | 0 | 0 |
| $\sigma_{0^-}^{\#1}$ | 0 | 0 | 0 | $\frac{1}{k^2 r_2 + t_2}$ |

| | $\omega_{0^+}^{\#1}$ | $f_{0^+}^{\#1}$ | $f_{0^+}^{\#2}$ | $\omega_{0^-}^{\#1}$ |
|---|---|---|---|---|
| $\omega_{0^+}^{\#1}\,\dagger$ | $6k^2 r_3$ | 0 | 0 | 0 |
| $f_{0^+}^{\#1}\,\dagger$ | 0 | 0 | 0 | 0 |
| $f_{0^+}^{\#2}\,\dagger$ | 0 | 0 | 0 | 0 |
| $\omega_{0^-}^{\#1}\,\dagger$ | 0 | 0 | 0 | $k^2 r_2 + t_2$ |

| | $\omega_{2^+}^{\#1}{}_{\alpha\beta}$ | $f_{2^+}^{\#1}{}_{\alpha\beta}$ | $\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$ |
|---|---|---|---|
| $\omega_{2^+}^{\#1}\,\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $f_{2^+}^{\#1}\,\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $\omega_{2^-}^{\#1}\,\dagger^{\alpha\beta\chi}$ | 0 | 0 | 0 |

| | $\sigma_{2^-}^{\#1}\,\dagger^{\alpha\beta\chi}$ | $\tau_{2^+}^{\#1}\,\dagger^{\alpha\beta}$ | $\sigma_{2^+}^{\#1}\,\dagger^{\alpha\beta}$ |
|---|---|---|---|
| $\sigma_{2^+}^{\#1}{}_{\alpha\beta}$ | 0 | 0 | 0 |
| $\tau_{2^+}^{\#1}{}_{\alpha\beta}$ | 0 | 0 | 0 |
| $\sigma_{2^-}^{\#1}{}_{\alpha\beta\chi}$ | 0 | 0 | 0 |