Particle spectrograph

Lagrangian density

$$\frac{2}{3} t_3\, \omega_\iota{}^{\alpha\iota}\, \omega_{\kappa\alpha}{}^{\kappa} + \frac{2}{3} t_2\, \omega_\iota{}^{\kappa\lambda}\, \omega_{\kappa\lambda}{}^{\iota} + \frac{1}{3} t_2\, \omega_{\kappa\lambda}{}^{\iota}\, \omega^{\kappa\lambda}{}_{\iota} - r_5\, \partial_\iota \omega^{\kappa\lambda}{}_{\kappa} \partial^\iota \omega_\lambda{}^\alpha{}_\alpha + \frac{2}{3} r_2\, \partial^\beta \omega^{\theta\alpha}{}_{\kappa} \partial_\theta \omega_{\alpha\beta}{}^{\kappa} - \frac{1}{3} r_2\, \partial_\theta \omega_{\alpha\beta}{}^{\kappa} \partial_\kappa \omega^{\alpha\beta\theta} -$$
$$\frac{2}{3} r_2\, \partial_\theta \omega_{\alpha\beta}{}^{\kappa} \partial_\kappa \omega^{\theta\alpha\beta} - r_5\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial_\kappa \omega^{\theta\kappa\lambda} + r_5\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial_\kappa \omega^{\theta\kappa\lambda} - r_5\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial_\kappa \omega^{\kappa\lambda\theta} + 2 r_5\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial_\kappa \omega^{\kappa\lambda\theta} +$$
$$\frac{1}{6} t_2\, \partial^\alpha f_{\theta\kappa} \partial^\kappa f_\alpha{}^\theta - \frac{1}{6} t_2\, \partial^\alpha f_{\kappa\theta} \partial^\kappa f_\alpha{}^\theta + \frac{1}{6} t_2\, \partial^\alpha f^\lambda{}_\kappa \partial^\kappa f_{\alpha\lambda} - \frac{2}{3} t_3\, \omega_{\kappa\alpha}{}^{\alpha}\, \partial^\kappa f^\iota{}_\iota - \frac{2}{3} t_3\, \omega_{\kappa\lambda}{}^{\lambda}\, \partial^\kappa f^\iota{}_\iota - \frac{4}{3} t_3\, \partial^\alpha f_{\kappa\alpha} \partial^\kappa f^\iota{}_\iota +$$
$$\frac{2}{3} t_3\, \partial_\kappa f^\lambda{}_\lambda \partial^\kappa f^\iota{}_\iota + \frac{1}{3} t_2\, \omega_{\iota\theta\kappa}\, \partial^\kappa f^{\iota\theta} - \frac{2}{3} t_2\, \omega_{\iota\kappa\theta}\, \partial^\kappa f^{\iota\theta} - \frac{1}{3} t_2\, \omega_{\theta\iota\kappa}\, \partial^\kappa f^{\iota\theta} + \frac{2}{3} t_2\, \omega_{\theta\kappa\iota}\, \partial^\kappa f^{\iota\theta} + \frac{2}{3} t_3\, \omega_{\iota\alpha}{}^{\alpha}\, \partial^\kappa f^\iota{}_\kappa +$$
$$\frac{2}{3} t_3\, \omega_{\iota\lambda}{}^{\lambda}\, \partial^\kappa f^\iota{}_\kappa - \frac{1}{6} t_2\, \partial^\alpha f^\lambda{}_\kappa \partial^\kappa f_{\lambda\alpha} - \frac{1}{6} t_2\, \partial_\kappa f_\theta{}^\lambda \partial^\kappa f_\lambda{}^\theta + \frac{1}{6} t_2\, \partial_\kappa f^\lambda{}_\theta \partial^\kappa f_\lambda{}^\theta + \frac{2}{3} t_3\, \partial^\alpha f^\lambda{}_\alpha \partial^\kappa f_{\lambda\kappa} + \frac{1}{3} r_2\, \partial_\kappa \omega^{\alpha\beta\theta} \partial^\kappa \omega_{\alpha\beta\theta} +$$
$$\frac{2}{3} r_2\, \partial_\kappa \omega^{\theta\alpha\beta} \partial^\kappa \omega_{\alpha\beta\theta} - \frac{2}{3} r_2\, \partial^\beta \omega_\iota{}^{\alpha\lambda} \partial_\lambda \omega_{\alpha\beta}{}^{\iota} + \frac{2}{3} r_2\, \partial^\beta \omega_\iota{}^{\lambda\alpha} \partial_\lambda \omega_{\alpha\beta}{}^{\iota} + r_5\, \partial_\alpha \omega_\lambda{}^\alpha{}_\theta \partial^\lambda \omega^{\theta\kappa}{}_\kappa - r_5\, \partial_\theta \omega_\lambda{}^\alpha{}_\alpha \partial^\lambda \omega^{\theta\kappa}{}_\kappa$$

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

Wave operator

	$\omega^{\#1}_{0^+}$	$f^{\#1}_{0^+}$	$f^{\#2}_{0^+}$	$\omega^{\#1}_{0^-}$
$\omega^{\#1}_{0^+}\dagger$	t_3	$-i\sqrt{2}\, k t_3$	0	0
$f^{\#1}_{0^+}\dagger$	$i\sqrt{2}\, k t_3$	$2k^2 t_3$	0	0
$f^{\#2}_{0^+}\dagger$	0	0	0	0
$\omega^{\#1}_{0^-}\dagger$	0	0	0	$k^2 r_2 + t_2$

	$\omega^{\#1}_{1^+}{}_{\alpha\beta}$	$\omega^{\#2}_{1^+}{}_{\alpha\beta}$	$f^{\#1}_{1^+}{}_{\alpha\beta}$	$\omega^{\#1}_{1^-}{}_{\alpha}$	$\omega^{\#2}_{1^-}{}_{\alpha}$	$f^{\#1}_{1^-}{}_{\alpha}$	$f^{\#2}_{1^-}{}_{\alpha}$
$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$k^2 r_5 + \frac{2t_2}{3}$	$\frac{\sqrt{2}\, t_2}{3}$	$\frac{1}{3} i\sqrt{2}\, k t_2$	0	0	0	0
$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{\sqrt{2}\, t_2}{3}$	$\frac{t_2}{3}$	$\frac{i k t_2}{3}$	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	$k^2 r_5 + \frac{2t_3}{3}$	$-\frac{\sqrt{2}\, t_3}{3}$	0	$-\frac{2}{3} i k t_3$
$\omega^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{\sqrt{2}\, t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3} i\sqrt{2}\, k t_3$
$f^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{2 i k t_3}{3}$	$-\frac{1}{3} i\sqrt{2}\, k t_3$	0	$\frac{2k^2 t_3}{3}$

	$\omega^{\#1}_{2^+}{}_{\alpha\beta}$	$f^{\#1}_{2^+}{}_{\alpha\beta}$	$\omega^{\#1}_{2^-}{}_{\alpha\beta\chi}$
$\omega^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	0	0
$f^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	0	0
$\omega^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	0

Saturated propagator

	$\sigma^{\#1}_{0^+}$	$\tau^{\#1}_{0^+}$	$\tau^{\#2}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	$\frac{1}{(1+2k^2)^2 t_3}$	$-\frac{i\sqrt{2}\, k}{(1+2k^2)^2 t_3}$	0	0
$\tau^{\#1}_{0^+}\dagger$	$\frac{i\sqrt{2}\, k}{(1+2k^2)^2 t_3}$	$\frac{2k^2}{(1+2k^2)^2 t_3}$	0	0
$\tau^{\#2}_{0^+}\dagger$	0	0	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	0	0	$\frac{1}{k^2 r_2 + t_2}$

	$\sigma^{\#1}_{1^+}{}_{\alpha\beta}$	$\sigma^{\#2}_{1^+}{}_{\alpha\beta}$	$\tau^{\#1}_{1^+}{}_{\alpha\beta}$	$\sigma^{\#1}_{1^-}{}_{\alpha}$	$\sigma^{\#2}_{1^-}{}_{\alpha}$	$\tau^{\#1}_{1^-}{}_{\alpha}$	$\tau^{\#2}_{1^-}{}_{\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{k^2 r_5}$	$-\frac{\sqrt{2}}{k^2 r_5 + k^4 r_5}$	$-\frac{i\sqrt{2}}{k r_5 + k^3 r_5}$	0	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	$-\frac{\sqrt{2}}{k^2 r_5 + k^4 r_5}$	$\frac{3k^2 r_5 + 2t_2}{(k+k^3)^2 r_5 t_2}$	$\frac{i(3k^2 r_5 + 2t_2)}{k(1+k^2)^2 r_5 t_2}$	0	0	0	0
$\tau^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{i\sqrt{2}}{k r_5 + k^3 r_5}$	$-\frac{i(3k^2 r_5 + 2t_2)}{k(1+k^2)^2 r_5 t_2}$	$\frac{3k^2 r_5 + 2t_2}{(1+k^2)^2 r_5 t_2}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{1}{k^2 r_5}$	$\frac{\sqrt{2}}{k^2 r_5 + 2k^4 r_5}$	0	$\frac{2i}{k r_5 + 2k^3 r_5}$
$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{\sqrt{2}}{k^2 r_5 + 2k^4 r_5}$	$\frac{3k^2 r_5 + 2t_3}{(k+2k^3)^2 r_5 t_3}$	0	$\frac{i\sqrt{2}\,(3k^2 r_5 + 2t_3)}{k(1+2k^2)^2 r_5 t_3}$
$\tau^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{2i}{k r_5 + 2k^3 r_5}$	$-\frac{i\sqrt{2}\,(3k^2 r_5 + 2t_3)}{k(1+2k^2)^2 r_5 t_3}$	0	$\frac{6k^2 r_5 + 4t_3}{(1+2k^2)^2 r_5 t_3}$

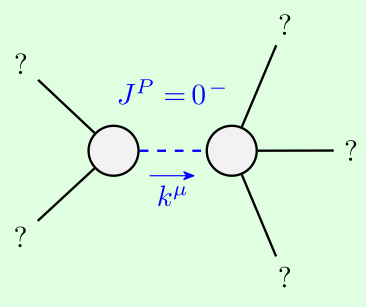
	$\sigma^{\#1}_{2^+}{}_{\alpha\beta}$	$\tau^{\#1}_{2^+}{}_{\alpha\beta}$	$\sigma^{\#1}_{2^-}{}_{\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	0	0
$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	0	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	0

Source constraints

Source constraints

SO(3) irreps	#
$\tau^{\#2}_{0^+} == 0$	1
$\tau^{\#1}_{0^+} - 2 i k\, \sigma^{\#1}_{0^+} == 0$	1
$\tau^{\#2}_{1^-}{}^{\alpha} + 2 i k\, \sigma^{\#2}_{1^-}{}^{\alpha} == 0$	3
$\tau^{\#1}_{1^-}{}^{\alpha} == 0$	3
$\tau^{\#1}_{1^+}{}^{\alpha\beta} + i k\, \sigma^{\#2}_{1^+}{}^{\alpha\beta} == 0$	3
$\sigma^{\#1}_{2^-}{}^{\alpha\beta\chi} == 0$	5
$\tau^{\#1}_{2^+}{}^{\alpha\beta} == 0$	5
$\sigma^{\#1}_{2^+}{}^{\alpha\beta} == 0$	5
Total #:	26

Massive spectrum



Massive particle

Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$-\frac{t_2}{r_2} > 0$
Spin:	0
Parity:	Odd

Massless spectrum

(No massless particles)

Unitarity conditions

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$r_2 < 0$ && $t_2 > 0$