Particle spectrograph

Lagrangian density

$$-t_1\,\omega_{\iota}^{\alpha\iota}\,\omega_{\kappa\alpha}{}^{\kappa}-\frac{1}{3}t_1\,\omega_{\iota}^{\kappa\lambda}\,\omega_{\kappa\lambda}{}^{\prime}+\frac{2}{3}t_2\,\omega_{\iota}^{\kappa\lambda}\,\omega_{\kappa\lambda}{}^{\prime}+\frac{1}{3}t_1\,\omega_{\kappa\lambda}{}^{\prime}\,\omega^{\kappa\lambda}{}_{\iota}+\frac{1}{3}t_2\,\omega_{\kappa\lambda}{}^{\prime}\,\omega^{\kappa\lambda}{}_{\iota}-r_5\,\partial_{\iota}\omega^{\kappa\lambda}{}_{\kappa}\partial^{\prime}\omega_{\lambda}{}^{\alpha}{}_{\alpha}-r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\partial_{\kappa}\omega^{\theta\kappa\lambda}+r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\partial_{\kappa}\omega^{\theta\kappa\lambda}-$$
$$r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\partial_{\kappa}\omega^{\kappa\lambda\theta}+2\,r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}-\frac{1}{3}t_1\,\partial^{\alpha}f_{\theta\kappa}\partial^{\kappa}f_{\alpha}{}^{\theta}+\frac{1}{6}t_2\,\partial^{\alpha}f_{\theta\kappa}\partial^{\kappa}f_{\alpha}{}^{\theta}-\frac{2}{3}t_1\,\partial^{\alpha}f_{\kappa\theta}\partial^{\kappa}f_{\alpha}{}^{\theta}-\frac{1}{6}t_2\,\partial^{\alpha}f_{\kappa\theta}\partial^{\kappa}f_{\alpha}{}^{\theta}-\frac{1}{3}t_1\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\partial^{\kappa}f_{\alpha\lambda}+$$
$$\frac{1}{6}t_2\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\partial^{\kappa}f_{\alpha\lambda}+t_1\,\omega_{\kappa\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\iota}+t_1\,\omega_{\kappa\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\iota}+2\,t_1\,\partial^{\alpha}f_{\kappa\alpha}\partial^{\kappa}f^{\prime}{}_{\iota}-t_1\,\partial_{\kappa}f^{\lambda}{}_{\lambda}\partial^{\kappa}f^{\prime}{}_{\iota}+\frac{1}{3}t_1\,\omega_{\iota\theta\kappa}\,\partial^{\kappa}f^{\iota\theta}+\frac{1}{3}t_2\,\omega_{\iota\theta\kappa}\,\partial^{\kappa}f^{\iota\theta}+\frac{4}{3}t_1\,\omega_{\iota\kappa\theta}\,\partial^{\kappa}f^{\iota\theta}-$$
$$\frac{2}{3}t_2\,\omega_{\iota\kappa\theta}\,\partial^{\kappa}f^{\iota\theta}-\frac{1}{3}t_1\,\omega_{\theta\iota\kappa}\,\partial^{\kappa}f^{\iota\theta}-\frac{1}{3}t_2\,\omega_{\theta\iota\kappa}\,\partial^{\kappa}f^{\iota\theta}+\frac{2}{3}t_1\,\omega_{\theta\kappa\iota}\,\partial^{\kappa}f^{\iota\theta}+\frac{2}{3}t_2\,\omega_{\theta\kappa\iota}\,\partial^{\kappa}f^{\iota\theta}-t_1\,\omega_{\iota\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa}-t_1\,\omega_{\iota\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{1}{3}t_1\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\partial^{\kappa}f_{\lambda\alpha}-$$
$$\frac{1}{6}t_2\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\partial^{\kappa}f_{\lambda\alpha}+\frac{1}{3}t_1\,\partial_{\kappa}f_{\theta}{}^{\lambda}\partial^{\kappa}f_{\lambda}{}^{\theta}-\frac{1}{6}t_2\,\partial_{\kappa}f_{\theta}{}^{\lambda}\partial^{\kappa}f_{\lambda}{}^{\theta}+\frac{2}{3}t_1\,\partial_{\kappa}f^{\lambda}{}_{\theta}\partial^{\kappa}f_{\lambda}{}^{\theta}+\frac{1}{6}t_2\,\partial_{\kappa}f^{\lambda}{}_{\theta}\partial^{\kappa}f_{\lambda}{}^{\theta}-t_1\,\partial^{\alpha}f^{\lambda}{}_{\alpha}\partial^{\kappa}f_{\lambda\kappa}+r_5\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}-r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}$$

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

Wave operator

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\,\dagger$	$-t_1$	$i\sqrt{2}\,k\,t_1$	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	t_2

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{1}{6}(6\,k^2\,r_5+t_1+4\,t_2)$	$-\frac{t_1-2\,t_2}{3\sqrt{2}}$	$-\frac{i\,k\,(t_1-2\,t_2)}{3\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}\,\dagger^{\alpha\beta}$	$-\frac{t_1-2\,t_2}{3\sqrt{2}}$	$\frac{t_1+t_2}{3}$	$\frac{1}{3}i\,k\,(t_1+t_2)$	0	0	0	0
$f_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{i\,k\,(t_1-2\,t_2)}{3\sqrt{2}}$	$-\frac{1}{3}i\,k\,(t_1+t_2)$	$\frac{1}{3}k^2\,(t_1+t_2)$	0	0	0	0
$\omega_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	$k^2\,r_5-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$i\,k\,t_1$
$\omega_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$f_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$-i\,k\,t_1$	0	0	0

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

Saturated propagator

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\,\dagger$	$-\frac{1}{(1+2\,k^2)^2\,t_1}$	$\frac{i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	0	0
$\tau_{0^+}^{\#1}\,\dagger$	$-\frac{i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	$-\frac{2\,k^2}{(1+2\,k^2)^2\,t_1}$	0	0
$\tau_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{1}{t_2}$

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{2\,(t_1+t_2)}{3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2)}$	$\frac{\sqrt{2}\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{i\,\sqrt{2}\,k\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	0	0	0	0
$\sigma_{1^+}^{\#2}\,\dagger^{\alpha\beta}$	$\frac{\sqrt{2}\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{6\,k^2\,r_5+t_1+4\,t_2}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{i\,k\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	0	0	0	0
$\tau_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$-\frac{i\,\sqrt{2}\,k\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$-\frac{i\,k\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{k^2\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	0	0	0	0
$\sigma_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	0	$\frac{\sqrt{2}}{t_1+2\,k^2\,t_1}$	0	$\frac{2\,i\,k}{t_1+2\,k^2\,t_1}$
$\sigma_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$\frac{\sqrt{2}}{t_1+2\,k^2\,t_1}$	$\frac{-2\,k^2\,r_5+t_1}{(t_1+2\,k^2\,t_1)^2}$	0	$-\frac{i\,\sqrt{2}\,k\,(2\,k^2\,r_5-t_1)}{(t_1+2\,k^2\,t_1)^2}$
$\tau_{1^-}^{\#1}\,\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}\,\dagger^{\alpha}$	0	0	0	$-\frac{2\,i\,k}{t_1+2\,k^2\,t_1}$	$\frac{i\,\sqrt{2}\,k\,(2\,k^2\,r_5-t_1)}{(t_1+2\,k^2\,t_1)^2}$	0	$\frac{-4\,k^4\,r_5+2\,k^2\,t_1}{(t_1+2\,k^2\,t_1)^2}$

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

Source constraints

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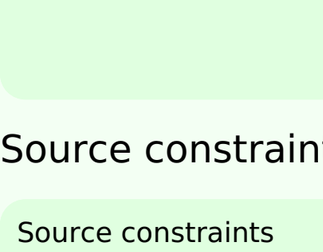
SO(3) irreps	#
$\tau_{0^+}^{\#2}==0$	1
$\tau_{0^+}^{\#1}-2\,i\,k\,\sigma_{0^+}^{\#1}==0$	1
$\tau_{1^-}^{\#2\,\alpha}+2\,i\,k\,\sigma_{1^-}^{\#2\,\alpha}==0$	3
$\tau_{1^-}^{\#1\,\alpha}==0$	3
$\tau_{1^+}^{\#1\,\alpha\beta}+i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta}==0$	3
$\tau_{2^+}^{\#1\,\alpha\beta}-2\,i\,k\,\sigma_{2^+}^{\#1\,\alpha\beta}==0$	5
Total #:	16

Massive spectrum



Massive particle

Pole residue:	$\frac{-3\,t_1\,t_2\,(t_1+t_2)+3\,r_5\,(t_1{}^2+2\,t_2{}^2)}{r_5\,(t_1+t_2)\,(-3\,t_1\,t_2+2\,r_5\,(t_1+t_2))}>0$
Polarisations:	3
Square mass:	$-\frac{3\,t_1\,t_2}{2\,r_5\,t_1+2\,r_5\,t_2}>0$
Spin:	1
Parity:	Even

Massless spectrum

(No massless particles)

Unitarity conditions

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$$r_5>0\;\&\&\;(t_1<0\;\&\&\;(t_2<0\,||\,t_2>-t_1))\,||\,(t_1>0\;\&\&\;-t_1<t_2<0)$$