Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#2}{}^{\alpha\beta}$	$\tau_{1^+}^{\#1}{}^{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}^{\alpha}$	$\sigma_{1^-}^{\#2}{}^{\alpha}$	$\tau_{1^-}^{\#1}{}^{\alpha}$	$\tau_{1^-}^{\#2}{}^{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\alpha\beta}\,\dagger$	$\frac{6\sqrt{2}}{(3+2k^2)^2 t_1}$	$-\frac{6i\sqrt{2}\,k}{(3+2k^2)^2 t_1}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\alpha\beta}\,\dagger$	$\frac{12}{(3+2k^2)^2 t_1}$	$\frac{12ik}{(3+2k^2)^2 t_1}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\alpha\beta}\,\dagger$	$-\frac{12ik}{(3+2k^2)^2 t_1}$	$\frac{12k^2}{(3+2k^2)^2 t_1}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\alpha}\,\dagger$	0	0	0	$\frac{\sqrt{2}}{t_1+2k^2 t_1}$	0	$\frac{2ik}{t_1+2k^2 t_1}$
$\sigma_{1^-}^{\#2}{}^{\alpha}\,\dagger$	0	0	$\frac{\sqrt{2}}{t_1+2k^2 t_1}$	$\frac{2k^2 r_1+t_1}{(t_1+2k^2 t_1)^2}$	0	$\frac{i\sqrt{2}\,k(2k^2 r_1+t_1)}{(t_1+2k^2 t_1)^2}$
$\tau_{1^-}^{\#1}{}^{\alpha}\,\dagger$	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\alpha}\,\dagger$	0	0	$-\frac{2ik}{t_1+2k^2 t_1}$	$-\frac{i\sqrt{2}\,k(2k^2 r_1+t_1)}{(t_1+2k^2 t_1)^2}$	0	$\frac{2k^2(2k^2 r_1+t_1)}{(t_1+2k^2 t_1)^2}$

Quadratic (free) Lagrangian density

$$
\begin{aligned}
&-t_1\,\omega_{\iota}^{\alpha\prime}\,\omega_{\kappa\alpha}^{\ \ \kappa}-\tfrac{1}{3}t_1\,\omega_{\iota}^{\ \kappa\lambda}\,\omega_{\kappa\lambda}^{\ \ \prime}+\tfrac{1}{3}t_1\,\omega_{\kappa\lambda}^{\ \ \prime}\,\omega^{\kappa\lambda}{}_{\iota}+f^{\alpha\beta}\,\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}+\\
&2\,r_1\,\partial_{\iota}\omega^{\kappa\lambda}{}_{\kappa}\,\partial^{\prime}\omega_{\lambda\ \alpha}^{\ \alpha}-\tfrac{2}{3}r_1\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}^{\ \ \kappa}-\tfrac{2}{3}r_1\,\partial_{\theta}\omega_{\ \alpha\beta}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta}+\\
&\tfrac{2}{3}r_1\,\partial_{\theta}\omega_{\alpha\beta}^{\ \ \kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta}+2\,r_1\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}-2\,r_1\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+\\
&2\,r_1\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}-4\,r_1\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}-\tfrac{1}{3}t_1\,\partial^{\alpha}f_{\theta\kappa}\,\partial^{\kappa}f_{\ \alpha}^{\theta}-\\
&\tfrac{2}{3}t_1\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\ \alpha}^{\theta}-\tfrac{1}{3}t_1\,\partial^{\alpha}f_{\kappa\alpha}\,\partial^{\kappa}f_{\ \iota}^{\prime}+t_1\,\omega_{\kappa\alpha}^{\ \ \alpha}\,\partial^{\kappa}f_{\ \iota}^{\prime}+t_1\,\omega_{\kappa\lambda}^{\ \ \lambda}\,\partial^{\kappa}f_{\ \iota}^{\prime}+\\
&2\,t_1\,\partial^{\alpha}f_{\kappa\alpha}\,\partial^{\kappa}f_{\ \iota}^{\prime}-t_1\,\partial_{\iota}f^{\kappa\lambda}\,\partial^{\prime}f_{\lambda\ \theta}^{\ \theta}+\tfrac{2}{3}t_1\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda\ \alpha}^{\ \theta}-t_1\,\partial^{\alpha}f_{\lambda\ \alpha}^{\ \lambda}\,\partial^{\kappa}f_{\lambda\kappa}+\\
&\tfrac{1}{3}t_1\,\omega_{\theta\iota\kappa}\,\partial^{\kappa}f^{\prime\theta}+\tfrac{2}{3}t_1\,\omega_{\theta\kappa\iota}\,\partial^{\kappa}f^{\prime\theta}-t_1\,\omega_{\iota\alpha}^{\ \ \alpha}\,\partial^{\kappa}f_{\ \kappa}^{\prime}-t_1\,\omega_{\iota\lambda}^{\ \ \lambda}\,\partial^{\kappa}f_{\ \kappa}^{\prime}+\\
&\tfrac{1}{3}t_1\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\,\partial^{\kappa}f_{\lambda\alpha}+\tfrac{1}{3}t_1\,\partial^{\kappa}f_{\kappa\alpha}\,\partial^{\alpha}f_{\ \iota}^{\lambda}-t_1\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda\ \alpha}^{\ \theta}-t_1\,\partial^{\alpha}f_{\lambda\ \alpha}^{\ \lambda}\,\partial^{\kappa}f_{\lambda\kappa}+\\
&\tfrac{2}{3}r_1\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}+\tfrac{2}{3}r_1\,\partial^{\beta}\omega_{\iota}^{\ \alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}^{\ \ \prime}-\\
&\tfrac{8}{3}r_1\,\partial^{\beta}\omega_{\iota}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}^{\ \ \prime}-2\,r_1\,\partial_{\alpha}\omega_{\lambda\ \theta}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}+2\,r_1\,\partial_{\theta}\omega_{\lambda\ \alpha}^{\ \alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}
\end{aligned}
$$

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

	$\sigma_{2^+}^{\#1}{}^{\alpha\beta}$	$\tau_{2^+}^{\#1}{}^{\alpha\beta}$	$\sigma_{2^-}^{\#1}{}^{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{2}{(1+2k^2)^2 t_1}$	$-\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	0
$\tau_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	$\frac{4k^2}{(1+2k^2)^2 t_1}$	0
$\sigma_{2^-}^{\#1}\,\dagger^{\alpha\beta\chi}$	0	0	$\frac{2}{2k^2 r_1+t_1}$

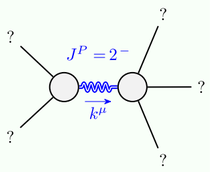
	$\omega_{1^+}^{\#1}{}^{\alpha\beta}$	$\omega_{1^+}^{\#2}{}^{\alpha\beta}$	$f_{1^+}^{\#1}{}^{\alpha\beta}$	$\omega_{1^-}^{\#1}{}^{\alpha}$	$\omega_{1^-}^{\#2}{}^{\alpha}$	$f_{1^-}^{\#1}{}^{\alpha}$	$f_{1^-}^{\#2}{}^{\alpha}$
$\omega_{1^+}^{\#1}{}^{\alpha\beta}\,\dagger$	$\frac{t_1}{6}$	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}{}^{\alpha\beta}\,\dagger$	$-\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	$\frac{ikt_1}{3}$	0	0	0	0
$f_{1^+}^{\#1}{}^{\alpha\beta}\,\dagger$	$\frac{ikt_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3}$	$\frac{k^2 t_1}{3}$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\alpha}\,\dagger$	0	0	0	$-k^2 r_1-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$-ikt_1$
$\omega_{1^-}^{\#2}{}^{\alpha}\,\dagger$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$f_{1^-}^{\#1}{}^{\alpha}\,\dagger$	0	0	0	0	0	0	ikt_1
$f_{1^-}^{\#2}{}^{\alpha}\,\dagger$	0	0	0	$-ikt_1$	0	ikt_1	0

	$\omega_{2^+}^{\#1}{}^{\alpha\beta}$	$f_{2^+}^{\#1}{}^{\alpha\beta}$	$\omega_{2^-}^{\#1}{}^{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{ikt_1}{\sqrt{2}}$	0
$f_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{ikt_1}{\sqrt{2}}$	$k^2 t_1$	0
$\omega_{2^-}^{\#1}\,\dagger^{\alpha\beta\chi}$	0	0	$k^2 r_1+\frac{t_1}{2}$

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\,\dagger$	$-t_1$	$i\sqrt{2}\,kt_1$	0	0
$f_{0^+}^{\#1}\,\dagger$	$-i\sqrt{2}\,kt_1$	$-2k^2 t_1$	0	0
$f_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\,\dagger$	0	0	0	0

Source constraints/gauge generators	Multiplicities
SO(3) irreps	
$\sigma_{0^-}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{0^+}^{\#1} - 2i\,k\,\sigma_{0^+}^{\#1} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2i\,k\,\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} - 2i\,k\,\sigma_{1^+}^{\#1\,\alpha\beta} == 0$	3
$2\,\sigma_{1^+}^{\#1\,\alpha\beta} + \sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\tau_{2^+}^{\#1\,\alpha\beta} - 2i\,k\,\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	20

Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{1}{r_1} > 0$
Polarisations:	5
Square mass:	$-\frac{t_1}{2r_1} > 0$
Spin:	2
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_1 < 0 \;\&\&\; t_1 > 0$