Particle spectrograph

Wave operator and propagator

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

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	t_3	$-i\sqrt{2}\,k\,t_3$	0	0
$f_{0^+}^{\#1}\dagger$	$i\sqrt{2}\,k\,t_3$	$2k^2 t_3$	0	0
$f_{0^+}^{\#2}\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\dagger$	0	0	0	$k^2 r_2 + t_2$

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

Source constraints/gauge generators

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

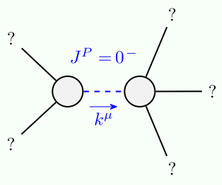
Quadratic (free) Lagrangian density

$$
\begin{aligned}
&-\frac{1}{3}t_1\,\omega_{\prime}^{\alpha\prime}\,\omega_{\kappa\alpha}^{\ \ \kappa}-\frac{2}{3}t_3\,\omega_{\prime}^{\alpha\prime}\,\omega_{\kappa\alpha}^{\ \ \kappa}-\frac{1}{3}t_1\,\omega_{\prime}^{\ \kappa\lambda\prime}\,\omega_{\kappa\lambda}^{\ \ \prime}+\frac{2}{3}t_2\,\omega_{\prime}^{\ \kappa\lambda\prime}\,\omega_{\kappa\lambda}^{\ \ \prime}+\\
&\frac{1}{3}t_1\,\omega_{\kappa\lambda}^{\ \ \prime}\,\omega^{\kappa\lambda}{}_{\prime}+\frac{1}{3}t_2\,\omega_{\kappa\lambda}^{\ \ \prime}\,\omega^{\kappa\lambda}{}_{\prime}+f^{\alpha\beta}\,\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}+\\
&\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{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}{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}+\frac{1}{3}t_1\,\omega_{\kappa\alpha}^{\ \ \alpha}\,\partial^{\kappa}f^{\prime}{}_{\prime}-\frac{2}{3}t_3\,\omega_{\kappa\alpha}^{\ \ \alpha}\,\partial^{\kappa}f^{\prime}{}_{\prime}+\\
&\frac{1}{3}t_1\,\omega_{\kappa\lambda}^{\ \ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\prime}-\frac{2}{3}t_3\,\omega_{\kappa\lambda}^{\ \ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\prime}+\frac{2}{3}t_1\,\partial^{\alpha}f_{\prime}^{\ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\lambda}+\frac{1}{3}t_1\,\omega_{\prime}^{\ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\lambda}-\\
&\frac{1}{3}t_1\,\partial_{\kappa}f_{\prime}^{\ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\lambda}+\frac{1}{3}t_2\,\omega_{\prime\theta\kappa}\,\partial^{\kappa}f^{\prime\theta}+\\
&\frac{1}{3}t_1\,\omega_{\prime\theta\kappa}\,\partial^{\kappa}f^{\prime\theta}-\frac{1}{3}t_2\,\omega_{\theta\prime\kappa}\,\partial^{\kappa}f^{\prime\theta}+\\
&\frac{4}{3}t_1\,\omega_{\prime\kappa\theta}\,\partial^{\kappa}f^{\prime\theta}-\frac{2}{3}t_2\,\omega_{\prime\kappa\theta}\,\partial^{\kappa}f^{\prime\theta}-\frac{1}{3}t_1\,\omega_{\theta\prime\kappa}\,\partial^{\kappa}f^{\prime\theta}+\\
&\frac{2}{3}t_1\,\omega_{\theta\kappa\prime}\,\partial^{\kappa}f^{\prime\theta}+\frac{2}{3}t_2\,\omega_{\theta\kappa\prime}\,\partial^{\kappa}f^{\prime\theta}-\frac{1}{3}t_1\,\omega_{\prime\alpha}^{\ \ \alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{2}{3}t_3\,\omega_{\prime\alpha}^{\ \ \alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa}-\\
&\frac{1}{3}t_1\,\omega_{\prime\lambda}^{\ \ \lambda}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{2}{3}t_3\,\omega_{\prime\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}+\frac{1}{3}t_1\,\partial^{\alpha}f^{\lambda}{}_{\alpha}\,\partial^{\kappa}f_{\lambda\kappa}+\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_{\prime}^{\ \alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}^{\ \ \prime}
\end{aligned}
$$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{1}{6}(t_1+4t_2)$	$-\frac{t_1-2t_2}{3\sqrt{2}}$	$-\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$-\frac{t_1-2t_2}{3\sqrt{2}}$	$\frac{t_1+t_2}{3}$	$\frac{1}{3}ik(t_1+t_2)$	0	0	0	0
$f_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{ik(t_1-2t_2)}{3\sqrt{2}}$	$-\frac{1}{3}ik(t_1+t_2)$	$\frac{1}{3}k^2(t_1+t_2)$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	$\frac{1}{6}(t_1+4t_3)$	$\frac{t_1-2t_3}{3\sqrt{2}}$	0	$\frac{1}{3}ik(t_1-2t_3)$
$\omega_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$\frac{t_1-2t_3}{3\sqrt{2}}$	$\frac{t_1+t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}\,k(t_1+t_3)$
$f_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	$-\frac{1}{3}ik(t_1-2t_3)$	$-\frac{1}{3}i\sqrt{2}\,k(t_1+t_3)$	0	$\frac{2}{3}k^2(t_1+t_3)$

	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\tau_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{i\sqrt{2}k(t_1-2t_2)}{3(1+k^2)t_1t_2}$	$\frac{\sqrt{2}(t_1-2t_2)}{3(1+k^2)t_1t_2}$	$\frac{2(t_1+t_2)}{3t_1t_2}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$\frac{ik(t_1+4t_2)}{3(1+k^2)^2t_1t_2}$	$\frac{t_1+4t_2}{3(1+k^2)^2t_1t_2}$	$\frac{\sqrt{2}(t_1-2t_2)}{3(1+k^2)t_1t_2}$	$-\frac{\sqrt{2}(t_1-2t_3)}{3(1+2k^2)t_1t_3}$	$\frac{t_1+4t_3}{3(1+2k^2)^2t_1t_3}$	0	0
$\sigma_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{k^2(t_1+4t_2)}{3(1+k^2)^2t_1t_2}$	$-\frac{ik(t_1+4t_2)}{3(1+k^2)^2t_1t_2}$	$\frac{2(t_1+t_2)}{3t_1t_2}$	$-\frac{2ikt_1-4ikt_3}{3t_1t_3+6k^2t_1t_3}$	$\frac{i\sqrt{2}k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$	0	$\frac{2k^2(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$
$\tau_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0
$\sigma_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	$\frac{2ikt_1-4ikt_3}{3t_1t_3+6k^2t_1t_3}$	$-\frac{i\sqrt{2}k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$	0	$\frac{2k^2(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$
$\tau_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0

Massive and massless spectra



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)

Unitarity conditions

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