Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	0	$-\frac{\sqrt{2}\,k}{t_1+k^2\,t_1}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}^{\dagger}{}^{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2\,t_1}$	$-\frac{2\,k^2\,r_1+t_1}{(1+k^2)^2\,t_1^2}$	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$\frac{i\,\sqrt{2}\,k}{t_1+k^2\,t_1}$	$\frac{i\,(2\,k^3\,r_1-k\,t_1)}{(1+k^2)^2\,t_1^2}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	$\frac{i\,(2\,k^3\,r_1-k\,t_1)}{(1+k^2)^2\,t_1^2}$	$\frac{6}{(3+4\,k^2)^2\,t_1}$	$\frac{6\,\sqrt{2}}{(3+4\,k^2)^2\,t_1}$	0	$\frac{12\,i\,k}{(3+4\,k^2)^2\,t_1}$
$\sigma_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	$\frac{-2\,k^4\,r_1+k^2\,t_1}{(1+k^2)^2\,t_1^2}$	$\frac{6\,\sqrt{2}}{(3+4\,k^2)^2\,t_1}$	$\frac{12}{(3+4\,k^2)^2\,t_1}$	0	$\frac{12\,i\,\sqrt{2}\,k}{(3+4\,k^2)^2\,t_1}$
$\tau_{1^-}^{\#1}{}^{\dagger}{}^{\alpha}$	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\dagger}{}^{\alpha}$	0	0	$-\frac{12\,i\,k}{(3+4\,k^2)^2\,t_1}$	$-\frac{12\,i\,\sqrt{2}\,k}{(3+4\,k^2)^2\,t_1}$	0	$\frac{24\,k^2}{(3+4\,k^2)^2\,t_1}$

Quadratic (free) Lagrangian density

$$-\frac{1}{3}\,t_1\,\omega_{\prime}{}^{\kappa\lambda}{}_{\alpha}{}^{\alpha\prime\prime}\,\omega_{\kappa\alpha}{}^{\kappa}{}^{\prime}-t_1\,\omega_{\prime}{}^{\kappa\lambda}\,\omega_{\kappa\lambda}{}^{\prime}+f^{\alpha\beta}\,\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}+r_1\,\partial_{\prime}\omega^{\kappa\lambda}\,\partial^{\prime}\omega_{\lambda}{}^{\alpha}{}_{\alpha}-$$
$$\frac{2}{3}\,r_1\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}-\frac{2}{3}\,r_1\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta}+$$
$$r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}-2\,r_1\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}-$$
$$\frac{1}{2}\,t_1\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\alpha}{}^{\theta}-\frac{1}{2}\,t_1\,\partial^{\alpha}f^{\kappa}{}_{\theta}\,\partial^{\lambda}f_{\alpha\lambda}+\frac{1}{3}\,t_1\,\omega_{\kappa\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\prime}+$$
$$\frac{1}{3}\,t_1\,\partial^{\alpha}f_{\kappa\alpha}\,\partial^{\kappa}f^{\prime}{}_{\prime}-\frac{1}{3}\,t_1\,\partial_{\kappa}f^{\lambda}{}_{\prime}\,\partial^{\kappa}f^{\prime}{}_{\lambda}+2\,t_1\,\omega_{\prime\kappa\theta}\,\partial^{\kappa}f^{\prime\theta}-$$
$$\frac{1}{3}\,t_1\,\omega_{\prime\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{1}{2}\,t_1\,\partial^{\alpha}f^{\kappa}{}_{\lambda\alpha}\,\partial^{\kappa}f_{\kappa}{}^{\lambda}{}_{\theta}+\frac{1}{2}\,t_1\,\partial_{\kappa}f_{\theta}{}^{\lambda}\,\partial^{\kappa}f_{\lambda}{}^{\theta}+$$
$$\frac{1}{3}\,t_1\,\omega_{\prime\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa}+\frac{1}{3}\,t_1\,\partial^{\alpha}f_{\alpha}{}^{\lambda}\,\partial^{\kappa}f_{\lambda\kappa}+\frac{2}{3}\,r_1\,\partial_{\kappa}\omega^{\alpha\beta\theta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}-\frac{2}{3}\,r_1\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta}+$$
$$\frac{1}{2}\,t_1\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda}{}^{\theta}-\frac{1}{3}\,t_1\,\partial_{\kappa}f_{\theta}{}^{\lambda}\,\partial^{\kappa}f_{\lambda}{}^{\theta}+\frac{2}{3}\,r_1\,\partial^{\beta}\omega_{\prime}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime}-\frac{8}{3}\,r_1\,\partial^{\beta}\omega_{\prime}{}^{\alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime}-r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}+r_1\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}$$

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

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	0	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	$-t_1$

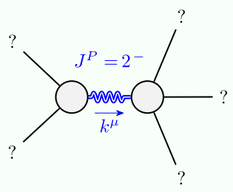
	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	0	0	0	0
$\tau_{0^+}^{\#1}{}^{\dagger}$	0	0	0	0
$\tau_{0^+}^{\#2}{}^{\dagger}$	0	0	0	0
$\sigma_{0^-}^{\#1}{}^{\dagger}$	0	0	0	$-\frac{1}{t_1}$

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{1^-}^{\#2\,\alpha}+2\,i\,k\,\sigma_{1^-}^{\#1\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\sigma_{1^-}^{\#1\,\alpha} == \sigma_{1^-}^{\#2\,\alpha}$	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 constraints:	20

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

Massive and massless spectra



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

(No massless particles)

Unitarity conditions

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