Particle spectrograph

Wave operator and propagator

$\sigma_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{1}{k^2\,(2\,r_3+r_5)}$	$-\frac{\sqrt{2}}{k^2\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{\sqrt{2}}{k^2\,(1+k^2)\,(2\,r_3+r_5)}$	$-\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{(k+k^3)^2\,(2\,r_3+r_5)\,t_2}$	$\frac{i\,(3\,k^2\,(2\,r_3+r_5)+2\,t_2)}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	$\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	$-\frac{i\,\sqrt{2}}{k\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{i\,\sqrt{2}}{k\,(1+k^2)\,(2\,r_3+r_5)}$	$-\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	$\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	$\frac{2}{k^2\,(r_3+2\,r_5)}$
$\sigma_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$-\frac{\sqrt{2}}{k^2\,(2\,r_3+r_5)}$	$\frac{3\,k^2\,(2\,r_3+r_5)+2\,t_2}{(k+k^3)^2\,(2\,r_3+r_5)\,t_2}$	$-\frac{i\,(3\,k^2\,(2\,r_3+r_5)+2\,t_2)}{k\,(1+k^2)^2\,(2\,r_3+r_5)\,t_2}$	0	0	0	0	0	0	0	0
$\tau_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{1}{k^2\,(2\,r_3+r_5)}$	$\frac{\sqrt{2}}{k^2\,(1+k^2)\,(2\,r_3+r_5)}$	$\frac{i\,\sqrt{2}}{k\,(1+k^2)\,(2\,r_3+r_5)}$	0	0	0	0	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0
$\sigma_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0
$\tau_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0

$\omega_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$k^2\,(2\,r_3+r_5)+\frac{2\,t_2}{3}$	$\frac{\sqrt{2}\,t_2}{3}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	0	0	0	0	0	0	0	0
$\omega_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	$\frac{\sqrt{2}\,t_2}{3}$			0	0	0	0	0	0	0	0
$f_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$			0	0	0	0	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	$\frac{1}{2}\,k^2\,(r_3+2\,r_5)$	0	0	0	0	0	0	0
$\omega_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0
$f_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0
$f_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0	0	0	0	0	0	0	0

Quadratic (free) Lagrangian density

$$\frac{2}{3}\,t_2\,\omega_{\prime}{}^{\kappa\lambda}\,\omega_{\kappa\lambda}{}^{\prime}+\frac{1}{3}\,t_2\,\omega_{\kappa\lambda}{}^{\prime}\,\omega^{\kappa\lambda}{}_{\prime}+\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-\frac{1}{2}\,r_3\,\partial_{\prime}\omega^{\kappa\lambda}{}_{\kappa}{}^{\prime}\,\partial^{\prime}\omega_{\lambda}{}^{\alpha}{}_{\alpha}-\frac{1}{2}\,r_3\,\partial_{\prime}\omega^{\kappa\lambda}{}_{\kappa}{}^{\prime}\,\partial^{\prime}\omega_{\lambda}{}^{\alpha}{}_{\alpha}+\frac{1}{2}\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}-\frac{1}{2}\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda}+\frac{1}{2}\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta}-\frac{1}{2}\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\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}{}^{\theta}{}_{\alpha}\,\partial^{\kappa}f_{\kappa}{}^{\lambda}{}_{\lambda}+\frac{1}{3}\,t_2\,\omega_{\iota\theta\kappa}\,\partial^{\kappa}f^{\prime\theta}-\frac{2}{3}\,t_2\,\omega_{\theta\kappa\prime}\,\partial^{\kappa}f^{\prime\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{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}{6}\,t_2\,\partial^{\alpha}f_{\lambda}{}^{\theta}\,\partial^{\kappa}f_{\theta}{}^{\lambda}{}_{\kappa}-4\,r_3\,\partial^{\beta}\omega_{\prime}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}^{\prime}-\frac{1}{6}\,t_2\,\partial^{\alpha}f_{\lambda}{}^{\theta}\,\partial^{\kappa}f_{\theta}{}^{\lambda}{}_{\kappa}+\frac{1}{2}\,r_3\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}+\frac{1}{2}\,r_3\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}-r_5\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa}$$

	$\sigma_{0^+}^{\#1}{}^{\dagger}$	$\tau_{0^+}^{\#1}{}^{\dagger}$	$\tau_{0^+}^{\#2}{}^{\dagger}$	$\sigma_{0^-}^{\#1}{}^{\dagger}$
$\sigma_{0^+}^{\#1}$	0	0	0	$\frac{1}{t_2}$
$\tau_{0^+}^{\#1}$	0	0	0	0
$\tau_{0^+}^{\#2}$	0	0	0	0
$\sigma_{0^-}^{\#1}$	0	0	0	0

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	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_2

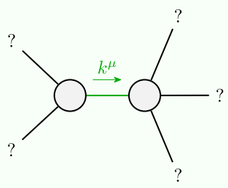
Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	25

	$\sigma_{2^+\,\alpha\beta}^{\#1}$	$\tau_{2^+\,\alpha\beta}^{\#1}$	$\sigma_{2^-\,\alpha\beta\chi}^{\#1}$
$\sigma_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{2}{3\,k^2\,r_3}$	0	0
$\tau_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	0	0
$\sigma_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	0	0

	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{3\,k^2\,r_3}{2}$	0	0
$f_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	0	0
$\omega_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	0	0

Massive and massless spectra



Quadratic pole

Pole residue:	$-\frac{1}{r_3\,(2\,r_3+r_5)\,(r_3+2\,r_5)\,p^2} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$$r_3 < 0\;\&\&\;(r_5 < -\frac{r_3}{2}\;||\;r_5 > -2\,r_3)\;||\;r_3 > 0\;\&\&\;-2\,r_3 < r_5 < -\frac{r_3}{2}$$