Particle spectrograph

Wave operator and propagator

	$\sigma_1^{\#1}{}_{\alpha}$	$\sigma_1^{\#2}{}_{\alpha}$	$\tau_1^{\#1}{}_{\alpha}$	$\tau_1^{\#2}{}_{\alpha}$
$\sigma_1^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\sigma_1^{\#2}{}_{\alpha\beta}$	0	0	0	0
$\tau_1^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\tau_1^{\#2}{}_{\alpha\beta}$	0	0	0	0

	$\sigma_1^{\#1}{}_{\alpha}$	$\sigma_1^{\#2}{}_{\alpha}$	$\tau_1^{\#1}{}_{\alpha}$	$\tau_1^{\#2}{}_{\alpha}$
$\sigma_1^{\#1}{}_{\alpha\beta}$	$\frac{6}{(3+4k^2)^2 t_1}$	$\frac{6\sqrt{2}}{(3+4k^2)^2 t_1}$	0	$\frac{12ik}{(3+4k^2)^2 t_1}$
$\sigma_1^{\#2}{}_{\alpha\beta}$	$\frac{6\sqrt{2}}{(3+4k^2)^2 t_1}$	$\frac{12}{(3+4k^2)^2 t_1}$	0	$\frac{12i\sqrt{2}\,k}{(3+4k^2)^2 t_1}$
$\tau_1^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\tau_1^{\#2}{}_{\alpha\beta}$	$-\frac{12ik}{(3+4k^2)^2 t_1}$	$-\frac{12i\sqrt{2}\,k}{(3+4k^2)^2 t_1}$	0	$\frac{24k^2}{(3+4k^2)^2 t_1}$

	$\sigma_1^{\#1}{}_{\alpha}$	$\sigma_1^{\#2}{}_{\alpha}$	$\tau_1^{\#1}{}_{\alpha}$	$\tau_1^{\#2}{}_{\alpha}$
$\sigma_1^{\#1}{}_{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	0	0
$\sigma_1^{\#2}{}_{\alpha\beta}$	$-\frac{2k^2 r_1+t_1}{(1+k^2)^2 t_1^2}$	$-\frac{i(2k^3 r_1-k t_1)}{(1+k^2)^2 t_1^2}$	0	0
$\tau_1^{\#1}{}_{\alpha\beta}$	$\frac{i(2k^3 r_1-k t_1)}{(1+k^2)^2 t_1^2}$	$\frac{-2k^4 r_1+k^2 t_1}{(1+k^2)^2 t_1^2}$	0	0
$\tau_1^{\#2}{}_{\alpha\beta}$	0	0	0	0

Quadratic (free) action

$$S_F == \iiint\left(\frac{1}{6}(-2t_1\,\omega_{\iota}{}^{\alpha\prime}\,\omega_{\kappa\alpha}{}^{\kappa} - 6t_1\,\omega_{\iota}{}^{\kappa\lambda}{}'\,\omega_{\kappa\lambda}{}' + 6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + 6\,r_1\,\partial_{\iota}\omega^{\kappa\lambda}{}_{\kappa}{}'\,\partial'\omega_{\lambda}{}^{\alpha} - 4\,r_1\,\partial^{\beta}\omega^{\theta\alpha}{}_{\kappa}\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa} - 4\,r_1\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\alpha\beta\theta} + 4\,r_1\,\partial_{\theta}\omega_{\alpha\beta}{}^{\kappa}\,\partial_{\kappa}\omega^{\theta\alpha\beta} + 6\,r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} - 6\,r_1\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\theta\kappa\lambda} + 6\,r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} - 12\,r_1\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial_{\kappa}\omega^{\kappa\lambda\theta} - 3t_1\,\partial^{\alpha}f_{\theta\kappa}\,\partial^{\kappa}f_{\alpha}{}^{\theta} - 3t_1\,\partial^{\alpha}f_{\kappa\theta}\,\partial^{\kappa}f_{\alpha}{}^{\theta} - 3t_1\,\partial^{\alpha}f_{\kappa}{}^{\theta}\,\partial^{\kappa}f_{\alpha\lambda} + 2t_1\,\omega_{\iota\kappa\alpha}\,\partial^{\kappa}f^{\prime}{}_{\iota} + 2t_1\,\omega_{\kappa\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\iota} + 4t_1\,\partial^{\alpha}f_{\kappa\alpha}\,\partial^{\kappa}f^{\prime}{}_{\iota} - 2t_1\,\partial_{\kappa}f^{\lambda}{}_{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\iota} + 12\,t_1\,\omega_{\iota\kappa\theta}\,\partial^{\kappa}f^{\prime\theta} - 2t_1\,\omega_{\iota\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\prime}{}_{\kappa} - 2t_1\,\omega_{\iota\lambda}{}^{\lambda}\,\partial^{\kappa}f^{\prime}{}_{\kappa} + 3t_1\,\partial^{\alpha}f^{\lambda}{}_{\kappa}\,\partial^{\kappa}f_{\lambda\alpha} + 3t_1\,\partial_{\kappa}f^{\lambda}{}_{\theta}\,\partial^{\kappa}f_{\lambda}{}^{\theta} - 2t_1\,\partial^{\alpha}f^{\lambda}{}_{\alpha}\,\partial^{\kappa}f_{\lambda\kappa} + 4\,r_1\,\partial_{\kappa}\omega^{\theta\alpha\beta}\,\partial^{\kappa}\omega_{\alpha\beta\theta} + 4\,r_1\,\partial^{\beta}\omega_{\iota}{}^{\alpha\lambda}\,\partial_{\lambda}\omega_{\alpha\beta}{}' - 16\,r_1\,\partial^{\beta}\omega_{\iota}{}^{\lambda\alpha}\,\partial_{\lambda}\omega_{\alpha\beta}{}' + 6\,r_1\,\partial_{\theta}\omega_{\lambda}{}^{\alpha}{}_{\alpha}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa} + 6\,r_1\,\partial_{\alpha}\omega_{\lambda}{}^{\alpha}{}_{\theta}\,\partial^{\lambda}\omega^{\theta\kappa}{}_{\kappa})\right)[t, x, y, z]\,dz\,dy\,dx\,dt$$

	$\omega_1^{\#1}{}_{\alpha}$	$\omega_1^{\#2}{}_{\alpha}$	$f_1^{\#1}{}_{\alpha}$	$f_1^{\#2}{}_{\alpha}$
$\omega_1^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\omega_1^{\#2}{}_{\alpha\beta}$	0	0	0	0
$f_1^{\#1}{}_{\alpha\beta}$	0	0	0	0

	$\omega_1^{\#1}{}_{\alpha}$	$\omega_1^{\#2}{}_{\alpha}$	$f_1^{\#1}{}_{\alpha}$	$f_1^{\#2}{}_{\alpha}$
$\omega_1^{\#1}{}_{\alpha\beta}$	0	0	0	$\frac{ikt_1}{3}$
$\omega_1^{\#2}{}_{\alpha\beta}$	0	0	$\frac{1}{3}i\sqrt{2}\,kt_1$	0
$f_1^{\#1}{}_{\alpha\beta}$	0	0	0	$\frac{2k^2 t_1}{3}$

	$\omega_1^{\#1}{}_{\alpha}$	$\omega_1^{\#2}{}_{\alpha}$	$f_1^{\#1}{}_{\alpha}$	$f_1^{\#2}{}_{\alpha}$
$\omega_1^{\#1}{}_{\alpha\beta}$	0	$\frac{t_1}{3\sqrt{2}}$	0	$\frac{ikt_1}{3}$
$\omega_1^{\#2}{}_{\alpha\beta}$	$\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	$\frac{1}{3}i\sqrt{2}\,kt_1$	0
$f_1^{\#1}{}_{\alpha\beta}$	0	0	0	$\frac{2k^2 t_1}{3}$

	$\omega_1^{\#1}{}_{\alpha}$	$\omega_1^{\#2}{}_{\alpha}$	$f_1^{\#1}{}_{\alpha}$	$f_1^{\#2}{}_{\alpha}$
$\omega_1^{\#1}{}_{\alpha\beta}$	0	0	0	0
$\omega_1^{\#2}{}_{\alpha\beta}$	0	0	0	0
$f_1^{\#1}{}_{\alpha\beta}$	0	0	0	0

	$\omega_1^{\#1}{}_{\alpha}$	$\omega_1^{\#2}{}_{\alpha}$	$f_1^{\#1}{}_{\alpha}$	$f_1^{\#2}{}_{\alpha}$
$\omega_1^{\#1}{}_{\alpha\beta}$	$k^2 r_1 - \frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$\frac{ikt_1}{\sqrt{2}}$	0
$\omega_1^{\#2}{}_{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0
$f_1^{\#1}{}_{\alpha\beta}$	$\frac{ikt_1}{\sqrt{2}}$	0	0	0

	$\omega_2^{\#1}{}_{\alpha\beta}$	$f_2^{\#1}{}_{\alpha\beta}$	$\omega_2^{\#1}{}_{\alpha\beta\chi}$
$\omega_2^{\#1}{}^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{ikt_1}{\sqrt{2}}$	0
$f_2^{\#1}{}^{\alpha\beta}$	$\frac{ikt_1}{\sqrt{2}}$	$k^2 t_1$	0
$\omega_2^{\#1}{}^{\alpha\beta\chi}$	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	$-t_1$

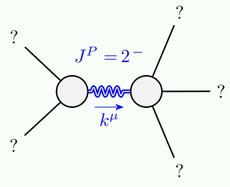
	$\sigma_{0^+}^{\#1}{}$	$\tau_{0^+}^{\#1}{}$	$\tau_{0^+}^{\#2}{}$	$\sigma_{0^-}^{\#1}{}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	0	0	0	0
$\tau_{0^+}^{\#1}{}^{\dagger}$	0	0	0	0
$\tau_{0^+}^{\#2}{}^{\dagger}$	0	0	0	0
$\sigma_{0^-}^{\#1}{}^{\dagger}$	0	0	0	$-\frac{1}{t_1}$

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

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

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

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