Particle spectrograph

Wave operator and propagator

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

Quadratic (free) action

$$S == \iiint\Big(\tfrac{1}{3}(3t_1\,\omega^{\alpha\prime}{}_{\alpha}{}^{\theta}\,\omega_{\prime}{}_{\theta}{}^{\theta}+3\,f^{\alpha\beta}\,\tau_{\alpha\prime}{}_{\beta}{}^{\theta}\,\tau_{\alpha\beta}+3\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-6t_1\,\omega_{\alpha}{}^{\theta}\,\partial_{\prime}f^{\alpha\prime}+6t_1\,\omega_{\prime}{}^{\theta}\,\partial^{\prime}f^{\alpha}{}_{\alpha}-3t_1\,\partial_{\prime}f^{\theta}{}_{\theta}\partial^{\prime}f^{\alpha}{}_{\alpha}-6r_1\,\partial_{\beta}\omega_{\prime}{}^{\theta}{}_{\theta}\,\partial^{\prime}\omega^{\alpha\beta}{}_{\alpha}-6r_1\,\partial_{\prime}\omega_{\beta}{}^{\theta}{}_{\theta}\,\partial^{\prime}\omega^{\alpha\beta}{}_{\alpha}+6r_1\,\partial_{\alpha}\omega^{\alpha\beta\prime}\,\partial_{\theta}\omega_{\prime}{}^{\theta}{}_{\beta}+12r_1\,\partial^{\prime}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\theta}\omega_{\prime}{}^{\theta}{}_{\beta}+6r_1\,\partial_{\alpha}\omega^{\alpha\beta\prime}\,\partial_{\theta}\omega_{\prime}{}^{\theta}{}_{\beta}+12r_1\,\partial^{\prime}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\theta}\omega_{\beta}{}^{\theta}{}_{\prime}-3t_1\,\partial_{\prime}f^{\alpha\prime}\,\partial_{\theta}f^{\alpha}{}_{\alpha}\,\partial^{\theta}f_{\prime}{}^{\theta}+6t_1\,\partial^{\prime}f^{\alpha}{}_{\alpha}\,\partial_{\theta}f_{\prime}{}^{\theta}\,\partial^{\theta}f^{\alpha\prime}+2t_1\,\partial_{\alpha}f_{\theta\prime}\,\partial^{\theta}f^{\alpha\prime}+t_1\,\partial_{\prime}f_{\alpha\theta}\,\partial^{\theta}f^{\alpha\prime}+2t_1\,\partial_{\alpha}f_{\theta\prime}\,\partial^{\theta}f^{\alpha\prime}+t_1\,\partial_{\theta}f_{\prime\alpha}\,\partial^{\theta}f^{\alpha\prime}+t_1\,\omega_{\alpha\prime\theta}\,(\omega^{\alpha\prime\theta}+2\,\partial^{\theta}f^{\alpha\prime})+t_1\,\omega_{\alpha\theta\prime}\,(\omega^{\alpha\prime\theta}+4\,\partial^{\theta}f^{\alpha\prime})-4r_1\,\partial_{\beta}\omega_{\alpha\prime\theta}\,\partial^{\theta}\omega^{\alpha\beta\prime}+2r_1\,\partial_{\beta}\omega_{\alpha\theta\prime}\,\partial^{\theta}\omega^{\alpha\beta\prime}-8r_1\,\partial_{\beta}\omega_{\prime\theta\alpha}\,\partial^{\theta}\omega^{\alpha\beta\prime}+2r_1\,\partial_{\theta}\omega_{\alpha\beta\prime}\,\partial^{\theta}\omega^{\alpha\beta\prime}+2r_1\,\partial_{\theta}\omega_{\alpha\prime\beta}\,\partial^{\theta}\omega^{\alpha\beta\prime}\Big)\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

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

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

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

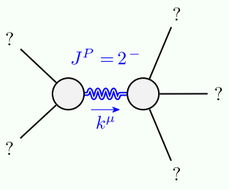
	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{ikt_1}{\sqrt{2}}$	0
$f_{2^+}^{\#1}{}^{\dagger}{}^{\alpha\beta}$	$\frac{ikt_1}{\sqrt{2}}$	k^2t_1	0
$\omega_{2^-}^{\#1}{}^{\dagger}{}^{\alpha\beta\chi}$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

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

Source constraints/gauge generators

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

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