

Particle spectrograph

Wave operator and propagator

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

Quadratic (free) action

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$$\begin{aligned} & \iiint \! \! \! \int \! \! \! \int (\frac{1}{6} (2t_1\omega_{\alpha}^{\alpha'}\omega_{\alpha'}^{\theta}{}_{,\theta}+6f^{\alpha\beta}\tau_{\alpha\beta}+6\omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi}-4t_1\omega_{\alpha}^{\theta}{}_{,\theta}\partial_{\theta}f^{\alpha'}+4t_1\omega_{,\theta}^{\theta} \\ & \partial'f^{\alpha}_{\alpha}-2t_1\partial_{\theta}f^{\theta}_{\theta}\partial'f^{\alpha}_{\alpha}-24r_3\partial_{\beta}\omega_{,\theta}^{\theta}\partial'w_{\alpha}^{\alpha\beta}-2t_1\partial_{\theta}f^{\alpha'}\partial_{\theta}f^{\theta}_{\alpha}+ \\ & 4t_1\partial'f^{\alpha}_{\alpha}\partial_{\theta}f^{\theta}_{,\theta}-24r_3\partial_{\alpha}\omega^{\alpha\beta'}\partial_{\theta}\omega_{,\beta}^{\theta}+48r_3\partial'w_{\alpha}^{\alpha\beta}\partial_{\theta}\omega_{,\beta}^{\theta}-6t_1\partial_{\alpha}f_{,\beta}^{\theta}\partial^{\theta}f^{\alpha'}- \\ & 3t_1\partial_{\alpha}f_{\theta'}\partial^{\theta}f^{\alpha'}+3t_1\partial_{\theta}f_{\alpha\theta}\partial^{\theta}f^{\alpha'}+3t_1\partial_{\theta}f_{\alpha'}\partial^{\theta}f^{\alpha'}+3t_1\partial_{\theta}f_{,\alpha}\partial^{\theta}f^{\alpha'}+ \\ & 6t_1\omega_{\alpha\theta'}(\omega^{\alpha'\theta}+2\partial^{\theta}f^{\alpha'})+8r_2\partial_{\beta}\omega_{\alpha'\theta}\partial^{\theta}\omega^{\alpha\beta'}-4r_2\partial_{\beta}\omega_{\alpha\theta'}\partial^{\theta}\omega^{\alpha\beta'}+ \\ & 4r_2\partial_{\beta}\omega_{,\theta\alpha}\partial^{\theta}\omega^{\alpha\beta'}-24r_3\partial_{\beta}\omega_{,\theta\alpha}\partial^{\theta}\omega^{\alpha\beta'}-2r_2\partial_{\theta}w_{\alpha\beta\theta}\partial^{\theta}\omega^{\alpha\beta'}+ \\ & 2r_2\partial_{\theta}w_{\alpha\beta'}\partial^{\theta}\omega^{\alpha\beta'}-4r_2\partial_{\theta}w_{\alpha'\beta}\partial^{\theta}\omega^{\alpha\beta'})[t,x,y,z]dzdydxdt \end{aligned}$$

$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2} \alpha\beta$	$f_{1+}^{\#1} \alpha\beta$	$\omega_{1-}^{\#1} \alpha$	$\omega_{1-}^{\#2} \alpha$	$f_{1-}^{\#1} \alpha$	$f_{1-}^{\#2} \alpha$
$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{ikt_1}{\sqrt{2}}$	0	0	0
$\omega_{1+}^{\#2} \dagger^{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0
$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{ikt_1}{\sqrt{2}}$	0	0	0	0	0
$\omega_{1-}^{\#1} \dagger^{\alpha}$	0	0	$\frac{t_1}{6}$	$\frac{t_1}{3\sqrt{2}}$	0	$\frac{ikt_1}{3}$
$\omega_{1-}^{\#2} \dagger^{\alpha}$	0	0	$\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	0	$\frac{1}{3}i\sqrt{2}kt_1$
$f_{1-}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0
$f_{1-}^{\#2} \dagger^{\alpha}$	0	0	$-\frac{1}{3}ikt_1$	$-\frac{1}{3}i\sqrt{2}kt_1$	0	$\frac{2k^2t_1}{3}$

Source constraints/gauge generators

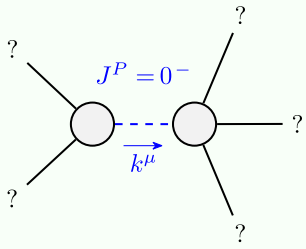
SO(3) irreps	Multiplicities
$\tau_{0+}^{\#2} == 0$	1
$\tau_{0+}^{\#1} == 0$	1
$\tau_{1-}^{\#2\alpha} + 2ik\sigma_{1-}^{\#1\alpha} == 0$	3
$\tau_{1-}^{\#1\alpha} == 0$	3
$\sigma_{1-}^{\#1\alpha} == \sigma_{1-}^{\#2\alpha}$	3
$\tau_{1+}^{\#1\alpha\beta} + ik\sigma_{1+}^{\#2\alpha\beta} == 0$	3
$\tau_{2+}^{\#1\alpha\beta} - 2ik\sigma_{2+}^{\#1\alpha\beta} == 0$	5
Total constraints:	19

$\sigma_{0+}^{\#1} \dagger$	$\sigma_{0+}^{\#1} \alpha$	$\tau_{0+}^{\#1} \alpha$	$\tau_{0+}^{\#2} \alpha$	$\sigma_{0-}^{\#1}$
$\sigma_{0+}^{\#1} \dagger$	$\frac{1}{6k^2}r_3$	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	$\frac{1}{k^2r_2t_1}$

$\omega_{0+}^{\#1} \dagger$	$f_{0+}^{\#1} \alpha$	$f_{0+}^{\#2} \alpha$	$\omega_{0-}^{\#1}$
$\omega_{0+}^{\#1} \dagger$	$6k^2r_3$	0	0
$f_{0+}^{\#1} \dagger$	0	0	0
$f_{0+}^{\#2} \dagger$	0	0	0
$\omega_{0-}^{\#1} \dagger$	0	0	$k^2r_2-t_1$

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

Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$\frac{t_1}{r_2} > 0$
Spin:	0
Parity:	Odd

No massless particles  
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Unitarity conditions

$r_2 < 0 \&\& t_1 < 0$