Particle spectrograph

Wave operator and propagator

Source constraints		
SO(3) irreps	Fundamental fields	Multiplicities
$\tau^{\#2}_{0^+} == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == 0$	1
$\tau^{\#2}_{1^-}{}^{\alpha} + 2\,i\,k\,\sigma^{\#2}_{1^-}{}^{\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$\tau^{\#1}_{1^-}{}^{\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$\tau^{\#1}_{1^+}{}^{\alpha\beta} + i\,k\,\sigma^{\#2}_{1^+}{}^{\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
Total constraints/gauge generators:		10

	$\sigma^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#2}_{1^+\,\alpha\beta}$	$\tau^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#1}_{1^-\,\alpha}$	$\sigma^{\#2}_{1^-\,\alpha}$	$\tau^{\#1}_{1^-\,\alpha}$	$\tau^{\#2}_{1^-\,\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	0	$\frac{2\sqrt{2}}{\alpha_0+\alpha_0 k^2}$	$\frac{2 i\sqrt{2} k}{\alpha_0+\alpha_0 k^2}$	0	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{2\sqrt{2}}{\alpha_0+\alpha_0 k^2}$	$-\frac{2}{\alpha_0(1+k^2)^2}$	$-\frac{2 i k}{\alpha_0(1+k^2)^2}$	0	0	0	0
$\tau^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{2 i\sqrt{2} k}{\alpha_0+\alpha_0 k^2}$	$\frac{2 i k}{\alpha_0(1+k^2)^2}$	$-\frac{2 k^2}{\alpha_0(1+k^2)^2}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	$-\frac{2\sqrt{2}}{\alpha_0+2\alpha_0 k^2}$	0	$-\frac{4 i k}{\alpha_0+2\alpha_0 k^2}$
$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{2\sqrt{2}}{\alpha_0+2\alpha_0 k^2}$	$-\frac{2}{\alpha_0(1+2k^2)^2}$	0	$-\frac{2 i\sqrt{2} k}{\alpha_0(1+2k^2)^2}$
$\tau^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{4 i k}{\alpha_0+2\alpha_0 k^2}$	$\frac{2 i\sqrt{2} k}{\alpha_0(1+2k^2)^2}$	0	$-\frac{4 k^2}{\alpha_0(1+2k^2)^2}$

Quadratic (free) action

$$S == \iiiint\left(f^{\alpha\beta}\,\tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + \alpha_0\left(-\tfrac{1}{2}\,\omega_{\alpha\zeta\beta}\,\omega^{\alpha\beta\zeta} - \tfrac{1}{2}\,\omega^{\alpha\beta}{}_{\alpha}\,\omega_{\beta}{}^{\zeta}{}_{\zeta} - f^{\alpha\beta}\,\partial_\beta\omega_{\alpha}{}^{\zeta}{}_{\zeta} + \partial_\beta\omega^{\alpha\beta}{}_{\alpha} + f^{\alpha\beta}\,\partial_\zeta\omega_{\alpha}{}^{\zeta}{}_{\beta} - f^{\alpha}{}_{\alpha}\,\partial_\zeta\omega^{\beta\zeta}{}_{\beta}\right)\right)[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\omega^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#2}_{1^+\,\alpha\beta}$	$f^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#1}_{1^-\,\alpha}$	$\omega^{\#2}_{1^-\,\alpha}$	$f^{\#1}_{1^-\,\alpha}$	$f^{\#2}_{1^-\,\alpha}$
$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{\alpha_0}{4}$	$\frac{\alpha_0}{2\sqrt{2}}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0	0	0
$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{\alpha_0}{2\sqrt{2}}$	0	0	0	0	0	0
$f^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0	0	0	0	0
$\omega^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{\alpha_0}{4}$	$-\frac{\alpha_0}{2\sqrt{2}}$	0	$-\frac{1}{2}\,i\,\alpha_0\,k$
$\omega^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{\alpha_0}{2\sqrt{2}}$	0	0	0
$f^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{i\alpha_0 k}{2}$	0	0	0

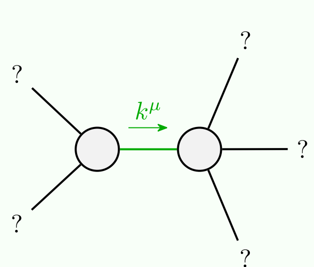
	$\omega^{\#1}_{0^+}$	$f^{\#1}_{0^+}$	$f^{\#2}_{0^+}$	$\omega^{\#1}_{0^-}$
$\omega^{\#1}_{0^+}\dagger$	$\frac{\alpha_0}{2}$	$-\frac{i\alpha_0 k}{\sqrt{2}}$	0	0
$f^{\#1}_{0^+}\dagger$	$\frac{i\alpha_0 k}{\sqrt{2}}$	0	0	0
$f^{\#2}_{0^+}\dagger$	0	0	0	0
$\omega^{\#1}_{0^-}\dagger$	0	0	0	$\frac{\alpha_0}{2}$

	$\sigma^{\#1}_{0^+}$	$\tau^{\#1}_{0^+}$	$\tau^{\#2}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	0	$-\frac{i\sqrt{2}}{\alpha_0 k}$	0	0
$\tau^{\#1}_{0^+}\dagger$	$\frac{i\sqrt{2}}{\alpha_0 k}$	$-\frac{1}{\alpha_0 k^2}$	0	0
$\tau^{\#2}_{0^+}\dagger$	0	0	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	0	0	$\frac{2}{\alpha_0}$

	$\omega^{\#1}_{2^+\,\alpha\beta}$	$f^{\#1}_{2^+\,\alpha\beta}$	$\omega^{\#1}_{2^-\,\alpha\beta\chi}$
$\omega^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{\alpha_0}{4}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0
$f^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0
$\omega^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$-\frac{\alpha_0}{4}$

	$\sigma^{\#1}_{2^+\,\alpha\beta}$	$\tau^{\#1}_{2^+\,\alpha\beta}$	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	$\frac{2 i\sqrt{2}}{\alpha_0 k}$	0
$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{2 i\sqrt{2}}{\alpha_0 k}$	$\frac{2}{\alpha_0 k^2}$	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$-\frac{4}{\alpha_0}$

Massive and massless spectra



Quadratic pole	
Pole residue:	$\frac{1}{\alpha_0} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$\alpha_0 > 0$