Particle spectrograph

Wave operator and propagator

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

Quadratic (free) action

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

$\tau_{1^+}^{\#1\,\alpha\beta}$

$\frac{2\,i\,\sqrt{2}\,k}{\alpha_0 + 2\,\alpha_0\,k^2}$	0	0	0
$-\frac{2\,i\,k}{\alpha_0\,(1+k^2)^2}$	0	0	0
$-\frac{2\,k^2}{\alpha_0\,(1+k^2)^2}$	0	0	0
0	0	0	0

$\sigma_{1^+}^{\#1\,\alpha\beta}$

0	0	0	0
$\frac{2\,\sqrt{2}}{\alpha_0 + 2\,\alpha_0\,k^2}$	0	0	0
$\frac{2}{\alpha_0\,(1+k^2)^2}$	0	0	0
$-\frac{2\,i\,k}{\alpha_0\,(1+k^2)^2}$	0	0	0

$\sigma_{1^+}^{\#2\,\alpha\beta}$

0	0	0	0
$\frac{2\,\sqrt{2}}{\alpha_0 + 2\,\alpha_0\,k^2}$	0	0	0
$\frac{2}{\alpha_0\,(1+k^2)^2}$	0	0	0
$-\frac{2\,i\,\sqrt{2}\,k}{\alpha_0\,(1+k^2)^2}$	0	0	0

$\tau_{1^-}^{\#1\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

$\sigma_{1^-}^{\#1\,\alpha}$

0	0	0	0
0	$-\frac{2\,\sqrt{2}}{\alpha_0 + 2\,\alpha_0\,k^2}$	0	0
0	0	0	0
0	$\frac{4\,i\,k}{\alpha_0 + 2\,\alpha_0\,k^2}$	0	0

$\tau_{1^-}^{\#2\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
0	$-\frac{4\,i\,k}{\alpha_0 + 2\,\alpha_0\,k^2}$	$-\frac{2\,i\,\sqrt{2}\,k}{\alpha_0\,(1+2\,k^2)^2}$	$-\frac{4\,k^2}{\alpha_0\,(1+2\,k^2)^2}$

$\omega_{1^+}^{\#1\,\alpha\beta}$

0	0	0	0
0	0	0	0
0	0	0	0
$\frac{\alpha_0}{4}$	$\frac{\alpha_0}{2\,\sqrt{2}}$	$-\frac{i\,\alpha_0\,k}{2\,\sqrt{2}}$	0

$\omega_{1^+}^{\#2\,\alpha\beta}$

0	0	0	0
0	0	0	0
0	0	0	0
$\frac{\alpha_0}{2\,\sqrt{2}}$	0	0	0

$f_{1^+}^{\#1\,\alpha\beta}$

0	0	0	0
0	0	0	0
0	0	0	0
$\frac{i\,\alpha_0\,k}{2\,\sqrt{2}}$	0	0	0

$\omega_{1^-}^{\#1\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
0	$-\frac{1}{2}\,i\,\alpha_0\,k$	0	0

$\omega_{1^-}^{\#2\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
$\frac{\alpha_0}{4}$	$-\frac{\alpha_0}{2\,\sqrt{2}}$	0	$\frac{i\,\alpha_0\,k}{2}$

$f_{1^-}^{\#1\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

$f_{1^-}^{\#2\,\alpha}$

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

$\omega_{0^+}^{\#1}$

0	0	0	$\frac{\alpha_0}{2}$

$f_{0^+}^{\#1}$

0	0	0	0

$f_{0^+}^{\#2}$

0	0	0	0

$\omega_{0^-}^{\#1}$

0	0	0	$\frac{\alpha_0}{2}$

$\sigma_{0^+}^{\#1}$

0	$-\frac{i\,\sqrt{2}}{\alpha_0\,k}$	0	0

$\tau_{0^+}^{\#1}$

$\frac{i\,\sqrt{2}}{\alpha_0\,k}$	$-\frac{1}{\alpha_0\,k^2}$	0	0

$\tau_{0^+}^{\#2}$

0	0	0	0

$\sigma_{0^-}^{\#1}$

0	0	0	$\frac{2}{\alpha_0}$

$\omega_{2^+}^{\#1\,\alpha\beta}$

$-\frac{\alpha_0}{4}$	$\frac{i\,\alpha_0\,k}{2\,\sqrt{2}}$	0	$-\frac{\alpha_0}{4}$
$-\frac{i\,\alpha_0\,k}{2\,\sqrt{2}}$	0	0	0
0	0	0	0

$f_{2^+}^{\#1\,\alpha\beta}$

$\frac{2\,i\,\sqrt{2}}{\alpha_0\,k}$	0	0	$-\frac{4}{\alpha_0}$
0	$-\frac{2\,i\,\sqrt{2}}{\alpha_0\,k}$	$-\frac{2}{\alpha_0\,k^2}$	0
0	0	0	0

$\omega_{2^-}^{\#1\,\alpha\beta\chi}$

0	0	$-\frac{\alpha_0}{4}$	0
0	0	0	0
$-\frac{\alpha_0}{4}$	0	0	0

$\sigma_{2^-}^{\#1\,\alpha\beta}$

0	0	$-\frac{4}{\alpha_0}$	0
0	$-\frac{4}{\alpha_0\,k^2}$	0	0
$-\frac{4}{\alpha_0}$	0	0	0

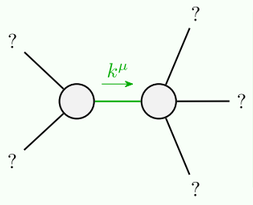
$\tau_{2^-}^{\#1\,\alpha\beta}$

0	$\frac{2\,i\,\sqrt{2}}{\alpha_0\,k}$	$\frac{2}{\alpha_0\,k^2}$	0
$\frac{2\,i\,\sqrt{2}}{\alpha_0\,k}$	0	0	0
$\frac{2}{\alpha_0\,k^2}$	0	0	0

$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$

0	0	0	$-\frac{\alpha_0}{4}$
0	0	$-\frac{\alpha_0}{4}$	0
0	$-\frac{\alpha_0}{4}$	0	0
$-\frac{\alpha_0}{4}$	0	0	0

Massive and massless spectra



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

(No massive particles)

Unitarity conditions

$\alpha_0 > 0$