

Particle spectrograph

Wave operator and propagator

$\sigma_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1+}^{\#2} \dagger^{\alpha\beta}$	$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{1-}^{\#1} \dagger^{\alpha}$	$\sigma_{1-}^{\#2} \dagger^{\alpha}$	$\tau_{1-}^{\#1} \dagger^{\alpha}$	$\tau_{1-}^{\#2} \dagger^{\alpha}$
0	$\frac{2\sqrt{2}}{\alpha_0 + \alpha_0 k^2}$	$-\frac{2i\sqrt{2}k}{\alpha_0 + \alpha_0 k^2}$	0	0	0	0
$\frac{2\sqrt{2}}{\alpha_0 + \alpha_0 k^2}$	$-\frac{2}{\alpha_0(1+k^2)^2}$	$-\frac{2ik}{\alpha_0(1+k^2)^2}$	0	0	0	0
0	0	0	$-\frac{2\sqrt{2}}{\alpha_0 + 2\alpha_0 k^2}$	$-\frac{2\sqrt{2}}{\alpha_0 + 2\alpha_0 k^2}$	$-\frac{4ik}{\alpha_0 + 2\alpha_0 k^2}$	$-\frac{4k^2}{\alpha_0(1+2k^2)^2}$
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Quadratic (free) action

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

$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2} \dagger^{\alpha\beta}$	$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1-}^{\#1} \dagger^{\alpha}$	$\omega_{1-}^{\#2} \dagger^{\alpha}$	$f_{1-}^{\#1} \dagger^{\alpha}$	$f_{1-}^{\#2} \dagger^{\alpha}$
$\frac{\alpha_0}{4}$	$\frac{\alpha_0}{2\sqrt{2}}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0	0	0
$\frac{\alpha_0}{2\sqrt{2}}$	0	0	$\frac{\alpha_0}{4}$	$-\frac{\alpha_0}{2\sqrt{2}}$	0	$-\frac{1}{2} i \alpha_0 k$
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

$\sigma_{0+}^{\#1} \dagger$	$\tau_{0+}^{\#1} \dagger$	$\tau_{0+}^{\#2} \dagger$	$\sigma_{0-}^{\#1} \dagger$
0	$-\frac{i\sqrt{2}}{\alpha_0 k}$	0	0
$\frac{i\sqrt{2}}{\alpha_0 k}$	$-\frac{1}{\alpha_0 k^2}$	0	0
0	0	0	$\frac{2}{\alpha_0}$

$\omega_{2+}^{\#1} \dagger^{\alpha\beta}$	$f_{2+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
$-\frac{\alpha_0}{4}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0
$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0
0	0	$-\frac{\alpha_0}{4}$

$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
0	$\frac{2i\sqrt{2}}{\alpha_0 k}$	0
$-\frac{2i\sqrt{2}}{\alpha_0 k}$	$\frac{2}{\alpha_0 k^2}$	0
0	0	$-\frac{4}{\alpha_0}$

Source constraints/gauge generators	
SO(3) irreps	Multiplicities
$\tau_{0+}^{\#2} == 0$	1
$\tau_{1-}^{\#2\alpha} + 2ik \sigma_{1-}^{\#2\alpha} == 0$	3
$\tau_{1-}^{\#1\alpha} == 0$	3
$\tau_{1+}^{\#1\alpha\beta} + ik \sigma_{1+}^{\#2\alpha\beta} == 0$	3
Total constraints:	10

Massive and massless spectra

Quadratic pole

Pole residue:

$\frac{1}{\alpha_0} > 0$

Polarisations:

2

(No massive particles)

Unitarity conditions

$\alpha_0 > 0$