

Particle spectrograph

Wave operator and propagator

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

Quadratic (free) action

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

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

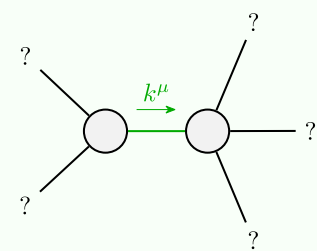
$\omega_{2+}^{\#1} \dagger^{\alpha\beta}$	$f_{2+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
$-\frac{\alpha_0}{4}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0
$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0
0	0	$-\frac{\alpha_0}{4}$

$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
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

$$\alpha_0 > 0$$